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ABSTRACT

A heuristic revolution, a new wave of learning technology, is about to transform not only the nature of education and training but the entire U.S. economy. By the end of the century, "knowledge jobs" will be the main employment of nearly three out of four workers in the U.S. economy. Swiftly progressing technologies are making automated instructional systems ever more effective. The learning enterprise has become the pivotal business in a new age when intellectual capital and human capital have become the cornerstones of prosperity. Knowledge work is rapidly becoming the major form of employment. As human capital becomes the key requirement of economic development, the U.S. human capital infrastructure is being exposed as seriously inadequate. Key actors in forming and directing the U.S. learning enterprise are the federal and state governments, formal education, employers, commercial sector, and "hidden matter" (cable television, periodicals, and instruction manuals). The persistence of the outmoded paradigm within which the learning enterprise traditionally has been envisioned is spawning growing gaps in the creation and adoption of potent new heuristic technology, measures of the learning enterprise's true performance, and public and private policies. How beneficial the revolution will be and who will benefit depend on choices and commitments being made today by the leaders and people of the United States. (67 references, 82 notes) (YLB)

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FURTHER EDUCATION AND TRAINING OF THE LABOUR FORCE

Country Reports : UNITED STATES

Following the OECD Intergovernmental Conference on Education and the Economy in a Changing Society held in Paris in March 1988, the Organisation -- on the recommendation of its Education Committee and its Manpower and Social Affairs Committee -- initiated new work on the Further Education and Training of the Labour Force.

As part of that new work, a number of Member countries agreed to prepare reports, according to a framework prepared by the Secretariat, that would provide for each of the countries concerned an overview of policies, practices, and institutional arrangements regarding the provision of and participation in further education and training of the labour force. The information made available in these country reports, together with other relevant material, will be brought together in a general report on the subject to be prepared by the Secretariat.

Attached is the report submitted by the United States authorities.

The Secretary-General of the OECD has agreed to make the report publicly available on his own responsibility.

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THE AMERICAN LEARNING ENTERPRISE IN TRANSITION

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PREFACE

The American Learning Enterprise in Transition is the United States' contribution to the Organisation for Economic Cooperation and Development's project on Further Education and Training of the Labor Force. The report was prepared by Dr. Lewis J. Perelman as part of the Hudson Institute's Workforce 2000 project, sponsored by a grant from the U.S. Department of Labor.

The views expressed in this study are solely those of the author, and do not necessarily represent the viewpoint of the U.S. Department of Labor.

Nevertheless, the Department of Labor believes that one of the most important contributors to continued economic growth and prosperity is a highly educated and trained workforce, and that this interesting and provocative report will serve as a useful catalyst for discussions in both the OECD and its member states on ways to ensure that our workers will be able to meet the challenges of the 21st century.

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1. Introduction: Defining a New Frame of Reference

The members of the Organisation for Economic Cooperation and Development are correct in their view (1) that further education and training -- in the sense of retooling the workforce and revitalizing the nation's human capital -- is a matter of high and growing importance for public policy. This is especially so and increasingly recognized in the United States.

The Secretariat is also right in its observation that a common frame of reference for examining this subject has been lacking and needed. In fact, the dynamic changes underway in education and training in the United States demand that this report provide and use a new frame of reference for policy analysis quite different from traditional paradigms of education, training, workforce, and economic policies.

This new framework also requires a somewhat different organization of this report from that suggested by the Secretariat's memo. But all the key issues and questions raised by the Secretariat are addressed here -- and more.

In particular, the Secretariat's memo invites alternative, more inclusive definitions of "further education," noting that the common use of this term "lacks a precise meaning." A different, far broader, definition of the subject in fact is used in this report, not only because "further education" is a virtually unknown term in U.S. policy circles, but because an unduly narrow focus on similar topics -- "adult education," "continuing education," or "retraining" -- would miss most of the critical trends and issues that are rapidly reshaping American education and training policy. Instead, the general argument presented here is this:

First, the relationship between learning, the workforce, and the performance of the national economy is far vaster and more powerful than what is visible in the narrow confines of "further" or "continuing" education and training. Programs and activities explicitly identified as serving purposes noted in the Secretariat's memo -- basically, to retrain adult workers and raise their basic skills -- are largely undocumented and, to the extent they are known, are minuscule in scale compared to the size of the formal system of elementary, secondary, and higher education. These "further education" activities cumulatively may represent a few billion dollars of investment, serving several hundred thousand persons -- tiny next to a formal American education system that spends over $330 billion annually to serve up to 50 million students. Investments specifically targeted on adult basic skills and retraining probably do not account for more than even one per cent of the mostly unmeasured and undocumented segment of education and training provided by U.S. employers -- a venture estimated to cost anywhere from $50 billion to $300 billion a year.

More to the point for policymaking: The failures and deficiencies of the rest of the entire education and training system are major causes of America's human capital crisis, and present major barriers to its remedy. The only framework adequate for assessing U.S. workforce policies and for meeting the adult learning needs that are essential to economic productivity and competitiveness is the entire national learning enterprise.

For this reason, this report gives substantial attention to the elementary and secondary sector of the U.S. education system. The scope, function, resources, and needs of "further" education and training for adults only can be understood in the context of the whole system, and particularly in regard to the system's treatment of and bias toward youth.

The second key argument of this report is that a revolution -- which I call "heuristic" for reasons explained within -- is rapidly unfolding in the United States that promises to radically alter the structure of the U.S. learning enterprise and its role in the overall economy within the next decade. This revolution is being driven by unprecedented changes in technology, economic structure, demography, and indeed the entire "ecology" of relationships that link these factors.

Third, the central policy issue that lies at the heart of the revolution that is leading toward a radically restructured American learning enterprise is a crisis of productivity. Briefly, not only has the education sector or learning enterprise become the U.S. economy's largest information industry -- perhaps even by some measure the nation's biggest industry overall -- but, in the emerging knowledge-based economy, it is the industry whose performance is most strategically critical to national prosperity and international competitiveness.

Yet the formal educational institutions that control roughly half the resources of the national learning industry are the most technologically backward and inefficient of all U.S. businesses. Spiralling costs and flagging output mark an enterprise whose productivity is not only poor but declining.

What is needed to break the U.S. learning enterprise's productivity logjam, and what is now beginning to happen in the United States, is a movement toward a policy of educational "restructuring" as bold and comprehensive as its namesake in Soviet perestroika. As in the Eastern bloc, the thrust of this movement is away from centralized, bureaucratic administration and toward open, competitive, entrepreneurial market arrangements.

To further this movement, governments at all levels in the United States need to replace a congeries of education, training, workforce, and economic development programs with a broad, strategic learning policy. As this report will demonstrate, the issues to be addressed in formulating such a policy framework -- linking learning technology to workforce quality and economic performance -- are vast and complex. Building national learning policies will require far more information and analysis about the largely hidden mass of the existing learning enterprise, and about the forces now reshaping it.

CHAPTER I

THE HEURISTIC REVOLUTION

A new wave of learning technology is about to transform not only the nature of education and training but the entire U.S. economy. "Learning technology" here means much more than what usually is thought of as "educational technology," discussions of which often focus on instructional computers. For just as the automobile was only the symbol of a host of technological and industrial innovations that changed the economic and social fabric of the 20th century world, the computer is only one star in a complex constellation of new technologies for and about learning that promises radical social change in the 21st century.

And keep in mind that for the American learning enterprise, the 21st century has already arrived: The class of the year 2000 is in America's schools today; over three-quarters of the people who will be "workforce 2000" are in the U.S. workforce today.

I call this constellation of technology "heuristic" because it extends learning beyond a solely human activity and beyond what we normally think of as instruction.

The terms "education" and "pedagogy" come from Latin and Greek words that mean "to lead" and they imply something that one person does to another. But the essence of the emerging revolution is that the new technology facilitates learning to occur in a person, or a group, or a system without force or coercion.

This kind of spontaneous, self-evolving learning may aptly be called "heuristic," from the Greek verb euriskos, meaning "to discover." So, heuristic technology is literally the technology of discovery. Already, heuristic technology is beginning to permeate every aspect of working and living outside of schools.

2. Technology Revolution I: Learning as Production

Until now, education and training, or teaching and learning, have been widely thought of primarily as preparation for working and living. Hence, policymakers, like the general public, tend to think of these processes as appropriate to childhood or adolescence, and as functions to be performed mainly inside the box of a school or classroom. But these assumptions, prejudices really, are already obsolete. By the end of this century, learning will be the main work of three out of four jobs in the U.S. economy.

To see today the kind of learning system that will permeate the 21st century American economy tomorrow, one can skip the local school or college and

look instead for a Buick dealership that has plugged into "CAMS" -- that's General Motors' new Computer Aided Maintenance System.

CAMS is a living example of what the computer engineers call an "expert system," one of several forms of so-called artificial intelligence (AI). At the core of CAMS is a mainframe computer in Flint, Michigan that is programd to know a great deal about how to maintain and repair a GM car. Linked by a telecommunications network to computer terminals right in the repair bay of a dealer's garage, CAMS is constantly available to help the mechanic figure out what's wrong with the customer's car and how to fix it. CAMS takes data directly from electronic testing instruments, asks and answers questions, and prescribes cures for automotive maladies. The objective, of course, is to improve customer service and save on warranty costs.

The development of CAMS is a harbinger of the future of learning in the entire postindustrial economy. When GM first piloted the CAMS system, mechanics rebelled and rejected the system. They felt that the computer was "de-skilling" their work and undercutting their aura of expertise.

So the CAMS program managers added a "manual" mode to give technicians control over a system that had been designed to make the processes of diagnosis and repair as automatic as possible. The managers subsequently found that most new CAMS users would rely on the automatic mode for a few weeks at first, but gradually would shift to the manual mode as their experience grew.

In other words, the mechanics learned from the computer expert, and became more expert and effective themselves. So CAMS turned out, completely inadvertently, to be a highly effective, automatic training system.

On the other hand, CAMS, like any good expert system, is not engraved in stone -- or even in silicon -- but is continually upgraded and improved. Each day, data about hundreds of car repairs is gathered from terminals in garages all over the country and fed back through the communications network to the main CAMS computer to be digested and applied to revising the expert program. In short, CAMS learns to be a better and better expert mechanic.

This is the kind of heuristic network or learning system that will comprise the brains and nerves of the entire 21st century economy. Machines helping humans to learn. Humans helping machines to learn. Nobody calls it or thinks of it as "education" or "training." There is no "school."

Still, expert systems like CAMS are only a crude prelude to the kind of learning technology that will begin to become commonplace in the 1990s. In order to "learn" their expertise, systems such as CAMS need to be assiduously programd and refined by a cadre of humans bearing the title of "knowledge engineer." These "expert" computers are still very dumb.

What will really unleash the learning revolution in the next decade are the accelerating advances of cognitive psychology and molecular psychology -- the sciences that are revealing the fundamental mechanisms that enable the living brain to produce a thinking mind. The application of these sciences is now permitting the engineering not only of machines that think, but of the human mind itself.

Growing knowledge of the brain's mechanics is being applied to the construction of thinking machines -- called "neural networks" -- that mimic in silicon and wire the simplest brains' wet architecture of protein and salt water. At Johns Hopkins University, scientists already have built a neural network machine that has learned to read. It was not programd to read, it learned through the same kind of trial-and-error process a five-year-old child goes through to accomplish the same result. The promise of neural networks is that they greatly increase the power of computers to recognize visual, sound, and other complex patterns in the way that living sensory organs do.

This technology is not "pie in the sky" -- it's here now: Japan's NEC corporation has announced that it will be marketing the world's first commercial personal neural-network computer this year. The price: about the same as an ordinary PC, around $3,000. Software is already available in the United States for only about $100 that will emulate a neutral network on a regular personal computer.

While expert systems and neural networks are exciting and profoundly useful advances in artificial intelligence, they are still pretty dumb. For specific applications they can perform brilliantly. Yet, give the same systems a problem different from the one they were specifically designed for, and they are totally stuck.

But a new programming technology called "SOAR" has now brought truly intelligent computers within reach. SOAR is both a theory about thinking and a thinking computer program developed by a team led by Allen Newell of Carnegie-Mellon University. SOAR is basically a program that solves problems -- any kind of problems. It has achieved one of the long-sought goals of AI research: it learns from its own experience. SOAR is the most human-like thinking machine yet developed. Scientists studying SOAR have found that, as its problem-solving experience accumulates, SOAR's thinking skills grow in stages much like those described by the famous Swiss child psychologist Jean Piaget.

The societal significance of the advent of these kinds of heuristic technology cannot be overstated. It represents nothing less than an evolutionary watershed in the history of our species and in fact our planet. In the beginning, all human learning was limited to what could be accumulated in a single human brain in one lifetime. The invention of spoken language, then written language, then printing and later electronic communications media incrementally expanded the human ability to accumulate and share knowledge among people and across generations. But all those innovations simply expanded the storage of information outside the human head; the basic processes of thinking, deciding, and learning still were mainly confined within the skull. Heuristic technology now is extending the learning process outside the human head and into the environment.

3. Technology Revolution II: Teaching as Discovery

The impact of evolving heuristic technology on teaching is to greatly increase the productivity of a process that currently costs the U.S. economy some $400 billion annually, that employs at least nine and perhaps 14 per cent

of the workforce, yet which is ever less responsive to key economic and social needs (2). Two decades of research shows that even rather ordinary computer-assisted instruction -- CAI -- produces about 30 per cent more learning in 40 per cent less time and at 30 per cent less cost than conventional classroom instruction (3). The widespread adoption of existing, already proven instructional technology could at least double the cost-effectiveness of teaching -- saving the American economy up to $100 billion a year (4).

But even greater gains in teaching productivity are promised by the continuing rapid advances in computer power in combination with the expanding educational use of related information technologies such as interactive videodiscs, compact discs, telecommunications networks, huge online databases, and sophisticated software using artificial intelligence. These swiftly progressing technologies are making automated instructional systems ever more effective. Their use is growing rapidly everywhere outside of schools -- in military training, in business and industry, and even in the home.

But CAI is just a crack in the door that leads to a brave new world of teaching technology.

Interactive compact discs -- called CD-I -- are just about to be introduced by the Sony and Philips Corporations. CD-I players are about the same size and cost as today's popular audio-only compact disc players, but include powerful computers that provide pictures and data as well as top quality stereo sound, and enable the user to access, or interact with the programs on the disc in many ways. The potential of these devices as instructional tools has made educators' heads spin. Sony and Philips expect CD-I to be in a quarter of American homes by the early 1990s. One expert, who happens to work in one of the country's largest school districts, has predicted that the spread of CD-I as an educational medium, as he put it, "will leave schools to be gulped down for dessert (5)."

And CD-I is only the beginning of the exploding world of what is called "hypermedia." A more powerful kind of interactive video system called "DVI" that can record up to an hour of full-motion television on a 5-inch compact disc, and that can be integrated with a variety of computer and video systems, will be introduced by the Intel Corporation in 1990.

Some educators worry that the very strength of computerized instructional systems -- that they provide totally individualized tutoring with infinite patience -- will isolate students and undermine "socialization." But the truth is just the opposite. Studies of CAI show that it actually increases interaction among students and between students and teachers (6). And another new wave of technology, technically called "hermeneutics" but more simply referred to as "groupware," is using computers to mediate meetings and conferences, enabling executives, engineers, and other groups that need to work together to collaborate far more effectively. Some examples of groupware are products called "The Coordinator," "INTO," "Higgins," "For Comment," and "Timbuktu." Applied to education, such new groupware will free up more time for group interaction, and make it more productive.

But this is still only a minor advance. Douglas Lenat -- the research director at the Microelectronics and Computer Technology Corp. (MCC) in Austin,

Texas -- is working on an even more remarkable product. "CYC," expected on the market in the next decade, is a kind of super-encyclopedia, containing three or four million facts, all boiled down to a single, fingernail-sized electronic chip that will fit in something the size of a fat wristwatch. With its "intelligent interface," CYC will tell you just about anything you want to know about just about anything you really want to know anything about. Just ask it a question; it will figure out what you want to learn even when you're not exactly sure yourself.

Consider that it has taken the American education establishment about two decades to decide that it doesn't make sense to spend weeks of class time forcing students to memorize multiplication tables or interpolate logarithms in a world where electronic calculators come built into rulers, pens, and key rings.

Against that history, it is easy to imagine how CYC's debut will confound the would-be education reformers who haveconsumed much ink and airtime agonizing about America's declining "cultural literacy." Clearly, it will make little sense to continue to spend time and money schooling students to memorize historical trivia in a world where anyone can answer millions of such questions simply by asking her wristwatch.

4. Economic Revolution: The Learning Enterprise as a Critical Industry

Leading futurists -- Daniel Bell, Alvin Toffler, John Naisbitt, George Gilder -- have been telling us that the world is at the threshold of an economic transformation as sweeping as the Agricultural Revolution and the Industrial Revolution: the rise of a postindustrial economy, in which information, communication, and expertise become the key factors of economic performance.

In American history, the waves of technological change have entailed massive shifts in the distribution of employment and the nature of work:

- Agriculture, which employed 70 percent of the U.S. labor force as recently as 1920, now employs only 4 per cent of the workforce and will account for only 2.5 per cent of the jobs in the 1990s (7).

- Manufacturing, which provided one of every four American jobs in 1960, accounted for only one of every five jobs in 1980 and will account for fewer than one job in six by the 1990s (8). Today, only 10 per cent of the U.S. labor force actually makes a product, and the number will decline over the next decade to only 5 to 7 per cent (9).

- From 1940 to 1980, service industries' share of total U.S. employment went from 45 percent to about 70 per cent, and, in the next decade, the shift to a predominantly services-based workforce will be nearly complete (10).

The shift to a postindustrial, knowledge-based economy -- now well underway in the United States -- has profound implications for the social role of the sector comprised of education, training, and other kinds of learning

activities that may not bear those labels. In particular, a comprehensive, 4-year study of the transition to this new economy, carried out by the U.S. Congress' Office of Technology Assessment (Kelly, 1988), came to the following conclusion:

> "Earlier economic transformations were associated with a major public investment in infrastructure: canals, railroads, electric lines, and highways. The transformation taking place today seems to require an entirely different kind of public involvement. An educated population is the most critical infrastructure of the emerging economy. It is critical for both the economic growth of the Nation as a whole, and the success of individuals acting as either consumers or employees."

While education always has been a central concern of American policy -- and of course has long been recognized as an important social need by governments of other nations -- OTA found that two new developments in the latest economic transition have given learning an even greater strategic importance:

> "First, the emerging economy places unprecedented demand on the intellectual skills and knowledge of American workers. Old standards of competence are no longer adequate. Second, technology is making it possible to look for significant changes in the productivity and quality of teaching and learning for the first time. A system allowing any person, anywhere, with any background, and any assortment of gaps in education, access to training on any subject is within the state of art of existing technology."

So technology is not only changing the form and potential of instruction. By imbuing the essential processes of production with new intelligence, technology is transforming the nature of work, and hence the requirements to be an effective worker.

These latter two impacts are examined further in the subsequent sections. The key point here is that the enterprise of learning has taken on an entirely new and vastly more crucial role in the emerging information age economy.

Knowledge is to the postindustrial economy what steel was to the industrial economy. Just as steelmaking was the strategically critical, capital-creating industry of the industrial era, the knowledge-producing industry -- or, simply, the learning enterprise -- has become the pivotal business in a new age when intellectual capital and human capital have become the cornerstones of prosperity.

5. Human Revolution I: Learning as Work

When mechanization swept the agricultural sector, a growing industrial sector was able to absorb the displaced farmers and field hands. When automation took off in manufacturing, an expanding services sector provided new job opportunities. But the postindustrial tide of automation is eliminating

more jobs in services than even in other sectors, raising the questions: Where are the displaced workers going to go? Where are the new job opportunities going to be found?

The most hopeful answer lies in the growth of the knowledge sector as a unique, fourth sector of the economy (after agriculture, mining, construction, manufacturing, and services).

Knowledge-work is rapidly becoming the major form of employment in modern society. Over the past 40 years in the United States, every 100 manufacturing jobs lost were replaced with 250 of what economist David Birch calls "thoughtware" jobs (Subcommittee..., 1983). By the beginning of the next century, nearly three-quarters of American workers could be employed in knowledge jobs -- performing functions that require uniquely human intelligence, imagination, and creativity.

Further evidence of the growing fusion of learning and work comes from the work of Shoshana Zuboff of the Harvard Business School, who has spent over ten years studying numerous examples of the impact of automation on work. In an important recent book (Zuboff, 1988) that summarizes her decade of research, she concludes this:

> "Learning is no longer a separate activity that occurs either before one enters the workplace or in remote classroom settings. Nor is it an activity preserved for a managerial group. The behaviors that define learning and the behaviors that define being productive are one and the same. Learning is not something that requires time out from being engaged in productivity; learning is the heart of productive activity."

Macroeconomic statistics tell us less about the content of work than the first-hand observations of a social scientist like Zuboff. But the available data are consistent with her and my observations.

In their study for the U.S. Labor Deptartment, Workforce 2000, William Johnston and Arnold Packer of the Hudson Institute found that the largest number of new jobs in the United States between now and the end of the century will be in predominantly white collar categories: services, management, sales, administration, technicians, health care, teaching, and engineering. Among the top ten job growth categories, only "mechanics, installers, and repairers" and "transportation/heavy equipment operators" might be considered blue collar kinds of jobs.

Even these latter jobs are becoming ever more technically sophisticated. For instance, it has been estimated that the automobile mechanic of a generation ago (e.g., the late 60s) had to know and use the knowledge in about 50,000 pages of shop manuals. The same job today requires knowing the contents of 500,000 pages of technical manuals. The CAMS example provided above is relevant in that it shows that even these kinds of jobs are becoming so knowledge-intensive that the worker is becoming more an information-manager than a tool-manipulator.

At the other end of the spectrum, the Hudson report finds that the largest number of American jobs lost in the next decade will be in such categories as fishing, farming, machine operator, hand worker, and mining.

Furthermore, research by Carnevale and Goldstein (1983) shows that the white collar kinds of jobs that the Hudson report finds will provide the greatest U.S. job growth by 2001 are about 40 per cent more training-intensive (in the sense of continuing, on-the-job, employer-provided training and education) than the average for all forms of employment. And, on the other hand, the disappearing, blue collar kinds of jobs are about 40 per cent less training-intensive than average.

In sum, the jobs that are growing most in the American economy are those that demand the most continuing retraining and re-education, and the fastest-disappearing jobs are those that demand the least learning-as-work.

Johnston and Packer also found that both the educational and the skill requirements of U.S. jobs are rapidly increasing. According to their analysis, while four years of high school or less education is sufficient preparation for 58 per cent of existing jobs, it will satisfy the requirements of only 49 per cent of new jobs in the next decade. At the same time, the majority -- 52 per cent -- of new American jobs will require at least one or more years of college education beyond high school, compared with only 42 per cent of current jobs demanding that level of education.

Education requirements are not necessarily the same thing as knowledge requirements. But when Johnston and Packer analyzed jobs in the United States in terms of their demands for measured language, reasoning, and mathematical skills, they found that 41 per cent of the new jobs in coming years will have requirements ranked at the highest levels of proficiency in these basic skills, compared with only 24 per cent of existing jobs demanding that high level of ability.

Workers do not need high levels of reading, communicating, and calculating skills to do the same tasks over and over. They need these skills to be able to continually learn new things. And, in fact, a variety of other studies indicate that the half-life of a job in today's U.S. economy is about five years -- that is, that the functional requirements of half of existing jobs completely change (whatever the formal job title) within half a decade.

Moreover, going back to the rise of education requirements charted in the Hudson Institute report, Carnevale's research shows that the most-educated workers in the U.S. economy also consume the most ongoing education and training. This implies that as the average level of education/training of workforce entrants goes up in the future, the demand for continuing, work-related education/training will accelerate.

Unfortunately, it also implies a growing gap between the top and bottom half of the American workforce as the more-educated become more employable and more educated, and the less-educated become less employable and therefore even less educated still. In short, the dark side of learning-as-work is that unwork (i.e., unemployment or even underemployment) means, in a sense, unlearning.

So, unless the existing U.S. system is drastically restructured to make lifelong learning or continuing education as substantive a reality for those who are temporarily out of work as for those who are working, the un- and

under-employed will find themselves falling behind not only in income but in employability even more rapidly than in the past.

What Knowledge Workers Do

Finally, the question becomes: What does learning-as-work mean on the job? What does a "knowledge worker" do? The obvious case is easy to discern: The white collar worker who works in an office, receives information from diverse sources -- paper, telephone, computer, fax, photo, etc. -- and processes it some way, makes decisions, creates new information, communicates to others in writing, speaking, making formal presentations, and attends meetings, conferences, trade shows, conventions, and even formal training programs to learn new things.

But this model of job performance increasingly can be observed in almost any occupation imaginable: travel agent, insurance claims processor, nurse, farmer, factory technician, TV weatherman, radiologist, librarian.

As the auto mechanic example suggests, even occupations traditionally thought of as blue collar or manual are, in fact, becoming knowledge/learning jobs. A good illustration of both why and how this is so is the case of American Steel & Wire, in Cleveland, as told in a recent issue of FORTUNE magazine (11):

> "Before Christmas last year some experts brought new computers into one mill for inventory control, set them up, and began to teach a steelworker the program to run the machine. But the experts ran out of time, saying they would return the next day. That night, the worker went home, sat down with his kids at a computer, and figured the program out. The next morning he went in and taught it to other workers. By the time the computer experts came back to complete the training, the guys in the mill already had the system up and running."

So what knowledge workers mainly do is learn and help others to learn. In the fourth sector of the emerging U.S. economy, and therefore increasingly in the whole postindustrial economy, learning is no longer preparation for work, learning is work.

Qualifying for the New Work: From IQ to Polymath

IQ tests were designed at the beginning of this century (notably by Binet) as a tool for screening military recruits. Over a period of decades they were progressively applied to American education, training, employment, and ultimately social policy. The spread of IQ as a tool of vocational and social "gatekeeping" was matched by growing pragmatic and ethical controversy.

Now the work of several contemporary researchers is showing that:

i) There are several kinds of human "intelligence" besides the basically academic kind measured by IQ tests; and

ii) The nonacademic, non-IQ kinds of intelligence are the more relevant to living and working in the new economy.

For instance, the work of Howard Gardner (1983) of Harvard University has revealed at least seven "intelligences" that people have in widely varying combinations:

i) Linguistic;
ii) musical;
iii) logical-mathematical;
iv) spatial;
v) bodily-kinesthetic;
vi) internal personal; and
vii) external personal.

Because the mix of these diverse talents vary almost infinitely among individuals, the quest for a single, comprehensive index of human competence, such as IQ, now appears futile.

The multiplicity of human talents turns out to be economically significant. In his report on Workplace Basics for the U.S. Labor Department, Anthony Carnevale of the American Society for Training and Development found that there are six other groups of "basic skills" besides the traditional "3 Rs" that now are considered by American business to be essential for any kind of employment in the 1990s and beyond:

i) Knowing how to learn;
ii) listening and oral communication;
iii) creative thinking and problem solving;
iv) personal management;
v) group effectiveness; and
vi) organizational effectiveness and leadership.

Traditional forms of schooling, whether for children or adults, are not only irrelevant to cultivating this broad range of competencies needed by the modern knowledge worker, but may even be harmful. A U.S. National Research Council report by Lauren Resnick (1987) of the University of Pittsburgh argues that the skills of thinking and working encouraged by conventional schooling are almost exactly opposite to those required for most of today's and tomorrow's jobs -- for instance: individual thinking in school versus shared thinking in the real world; pure thinking in school versus manipulating tools outside; symbolism in school versus practical reasoning on the job; and general principles in academe versus situation-specific competencies in the workplace (12).

In contrast, the new media of heuristic technology both demand and nurture the kinds of intelligence needed for work and life in the postindustrial economy that are thwarted by school. Mary Alice White of Columbia University observes that, in an era when imagery has become the cardinal form of communication -- private and public, functional and recreational -- classroom instruction remains mostly stuck on print (13).

It increasingly seems that the invisible parts of the learning enterprise, embodied in emerging heuristic media outside of formal schools, are more productive in nurturing the necessary abilities of the new knowledge worker than are most education and training institutions. For example, the U.S. Army finds that recreational video games hone tank crews' skills needed for the electronic battlefield; consequently, the Soviet education minister worries aloud that the shortage of video games in the Soviet Union may be impairing military effectiveness.

6. Human Revolution II: Lifespan Human Investment

At the same time that human capital is becoming the key requirement of economic development, America's human capital "infrastructure" is being exposed as seriously inadequate. There is a growing sense among employers, workers, and political leaders that America faces an acute workforce crisis. The looming crisis has several dimensions.

Functional Deficits

Some 20 per cent of American adults are functionally illiterate -- unable to read a job notice, fill out a job application, or make change. Twenty million English-speaking, native-born American adults read or write so poorly that they "have trouble holding jobs or suffer loss of self-esteem," according to the International Reading Association (14).

Not only does functional illiteracy handicap the individuals affected, it imposes enormous costs on American employers. Most of these costs are hidden. Anthony Carnevale estimates that no more than a few percent of employer training budgets yet go to providing direct remedial education for sub-literate employees (15). But other experts guess that a fifth or even a quarter of the $30 billion U.S. corporations spend each year on formal employee training is required to compensate for workers' functional deficiencies in basic skills -- in the sense that it costs more to train an employee with poor learning skills. For instance, William Wiggenhorn, training director of Motorola Corp., has estimated that it costs his company about $200 to train a U.S. production worker in the technique of statistical process control, while it costs his company's Japanese competitors less than a dollar to teach the same skill to their employees. The difference is that the American worker first must learn to read (16).

Worker Obsolescence

A growing number of adults have knowledge and skills which, though extensive, no longer fit the technological and other requirements of a rapidly changing economy. Most likely to be displaced by the new wave of automation and cost-cutting are not the unskilled, entry-level workers, but rather are experienced -- and expensive -- skilled blue-collar workers, white-collar middle managers in business and government, and even professionals such as lawyers and doctors.

During this decade several million U.S. workers became structurally unemployed -- that is, experienced the permanent loss of their old jobs because of shifts in the economy. The combination of robotization and foreign competition may have displaced some 10 million to 15 million manufacturing workers and a similar number of service workers in the course of the decade (17).

Demographic Issues

Demographic shifts specific to the United States are major factors in the workforce crisis (18). These include: the unbalanced population profile produced by a post-World War II "baby boom" and a subsequent sharp decline in fertility -- the "baby bust"; a swelling wave of both legal and illegal immigration; the diverse ethnic composition of the U.S. population; the dramati expansion of female participation in the workforce; the extension of life expectancy; and profound alteration in family structure.

As a result of the country's demographic waves, the U.S. workforce face in the 1990s a scarcity of young, entry-level workers and a relative surplus of middle-aged, more educated and experienced workers.

About 85 per cent of the new entrants to the U.S. workforce through the next decade will be females, minorities, and immigrants. Yet these are the groups most likely to be affected by inadequate educational preparation and discriminatory barriers. Because of the great diversity of the U.S. population educational attainment and workforce readiness vary widely among particular ethnic groups.

Nevertheless, most women and non-Asian minorities are unprepared for an unattracted to the scientific and technical vocations that are most critical to economic development and that face the most acute workforce shortages. About 85 per cent of American scientists and engineers are white males while, as noted, only 15 per cent of new entrants to the U.S. workforce will be white males. Females account for only five percent of U.S. engineers. Of the 800 or so PhDs earned by blacks in the last year, only a handful (literally) were in physics, mathematics, and computer science (19).

The U.S. workplace and family are being jointly transformed by the unprecedented entry of women into the workforce. Not only the majority of adul women, but the majority of married women are now working in America. A bellwether for the country is the Washington-Baltimore metropolitan area, where 70 per cent of women are in the workforce.

The changing economic role of women has been concurrent with changing family structure. Only about one U.S. household in eight now matches the stereotypical 1950s "family": a breadwinner husband and homemaker wife living together with their children. America's high divorce rate means that about half of all children can expect to live part of their childhood with a single parent. In general, not only do most mothers work, but most poor mothers work, and most single mothers are poor. While reduced discrimination and new opportunities attracted many women to the workforce, economic necessity played powerful role. Declining average real wages through the past two decades motivated many married women to work at least part time to maintain adequate

family income, while the rising rates of divorce and non-marriage made working necessary for other women.

One of the myriad consequences of these changes is an urgent need by working parents -- the majority -- for day care for children. Even as this nee goes underserved, the aging baby boom ge[illegible]ation finds themselves increasingly "sandwiched" with the added burden of caring for elderly parents.

All these trends combine to have powerful impacts on the workforce and the workplace generally. More particularly, they are rapidly altering previous conceptions of the role of education and training as "human capital investment.

Starting now and for the next decade or two at least, American employer no longer will employ individual workers but rather family units. The emerging workforce gives U.S. employers no choice but to provide or at least arrange for a full spectrum of what once were considered "social services" to employee families and even whole communities (20).

By analogy, the process of employing human capital has gone from simply harvesting a "worker farm" to managing a complex "human resource ecosystem." Hiring scarce new workers means providing day care for their preschool children and "elder care" for aged parents. It is an incremental step from the corporat day care center to the corporate school for employees' children, (21) especiall since the employer already has to serve the "basic education" needs of many of its employees. Getting prospective employees off welfare rolls means providing basic education and job training -- and day care (22). Cutting health insuranc costs (now greater than the cost of raw materials for some U.S. manufacturers) means health education for workers and families. "Wellness centers" for employee recreation readily can be combined with day care and elder care facilities. Making room at the top for employee advancement means promoting ne roles for retirees -- who now have 20 to 30 years of remaining life expectancy. Retirees and elderly may be able and willing to serve as tutors to combat workplace illiteracy. And so on.

"Basic education," "continuing (further) education," and "retraining" blend together into a single economic process. More than even "lifelong learning," it becomes a portfolio of <u>lifespan</u> investments in cultivating human resources, from pre-natal care to post-mortem estate planning.

Inflexibility

The dynamism of the new world economy demands that American workers and managers have to be more flexible to adapt their knowledge and skill to the rapidly changing requirements of technological innovation and international competition. The need for flexible, adaptive human capital affects virtually every member of the U.S. workforce and creates an unprecedented requirement for continual adult retraining. Not only will the average American worker need to be retrained for a new job every four or five years, but the functions of most jobs will require almost constant, on-the-job learning.

One by-product of the growth of the knowledge sector and the spread of "telematic" technologies (that is, the combination of computers and telecommunications) is the increasing transience and dynamism of work. Today,

some 36 per cent of the American adult working population is either in a work transition or anticipating one -- each year some 15 million men and women change their occupation (23).

Between 15 per cent and 20 per cent of the U.S. workforce is employed part-time. Temporary services, which 20 years ago was a $159-million-a-year industry employing only 400,000 people mostly in secretarial and clerical jobs, has grown to $5 billion in annual sales and employs four million people annuall in industrial, marketing, technical, security, legal, accounting, health care, and executive positions, in addition to its traditional office jobs (24).

And, because telematic technology permits knowledge work to be totally decentralized, by the next century as many as 30 per cent of American workers are projected to be "telecommuters" -- working outside of any factory or office.

These signs of adaptation are nevertheless inadequate. The United States has become a debtor nation, burdened by ongoing trade and budget deficits, at least in part because of a prolonged period of sluggish or negligible productivity growth, particularly in the large and growing services sector. While economists debate the technical causes of America's productivity problem, the country's inability to restructure its industry and retool its workforce fast enough stand as principal barriers to its solution.

From a macroeconomic perspective, the U.S. workforce may seem highly flexible -- arguably far more so than that of other OECD nations -- in regard to employment and location. That is, laying off, displacing, and firing employees is far more common and more accepted in the United States than elsewhere. And U.S. workers have been more likely -- at least until recently -- to accept transfers or to voluntarily migrate from one region to another.

Yet despite this kind of macro-flexibility, and perhaps even because of it, both employer practices and public programs in the United States have been notably less aggressive or effective at helping individual workers to adapt to changing economic requirements than in other countries.

In broad and simple terms, American employers have tended to adapt their workforces through hiring and firing, while Japanese and European employers have emphasized education and retraining. In the latter case, companies constrained to offer "lifetime" or at least long-term employment have had to be more demanding of workers' initial qualifications, and have had to invest more conscientiously in keeping employees' skills up to date. In the United States, greater responsibility has been given to individual workers to adapt themselves to the cycles of expansion and contraction -- and creation and destruction -- of enterprises.

However well the "macro" approach to workforce flexibility may have served the U.S. economy in the past, it no longer is viable as America faces a prolonged period of workforce shortages. Yet no new system has been installed on a national scale to ease or speed worklife transitions.

Stress

The product of the previous conditions is growing stress and frustration among both U.S. workers and employers. A society that has a large number of workers unprepared to function productively, that employs a workforce with mostly obsolescent skills, that is experiencing unprecedented demographic shifts, and that lacks a systematic process to quickly adapt its human capital to changing technologies and market conditions is a society that feels under great pressure, and that may be in jeopardy.

In the worst case, structural economic revolution contains the threat of turbulent, even violent, social upheaval as the economic ambitions of a major portion of the working population become increasingly frustrated. The past technological revolutions in agriculture and manufacturing were marked by strikes, riots, and rebellions; the transition to a postindustrial economy could be equally distressed.

The danger of worker frustration depends not only on the number of available jobs, but also on occupational status, the quality of work, and the opportunities for advancement and mobility. In fact, frustrations are growing today along all these dimensions in the United States.

For instance, the 1980s have witnessed an ongoing debate about whether economic transformation is leading to a more polarized, "two-tier" American workforce (25). The debate goes on because the data are mixed, inconclusive, and still changing.

What seems clear is that the nature of work and its meaning both to the U.S. economy as a whole and to individual American workers and families is undergoing a historical transformation. While technological change most likely is both expanding and enhancing employment overall, in specific cases it unquestionably has both eliminated and "deskilled" jobs. Many of the new employment opportunities a changing economy has created offer less compensation, benefits, and security than many of the jobs, mainly industrial, that have been displaced or downgraded. As a result, significant segments of the American workforce have been left stranded by the shifting economic tide (26).

Another, related source of social stress is the deskilling and obsolescence of middle-class work, which may provoke even greater frustration among managers and professionals than among industrial workers. For this group, the impact of technological change and structural economic shifts is compounded by the pressures of the demographic wave produced by the "baby boom" and subsequent "baby bust."

For example, from 1980 to 1990, the number of people 35 to 44 years old, the prime age for middle managers, grew twice as fast as the number of managerial jobs, (27) which increasingly are being eliminated in the quest for corporate efficiency.

The intense competition for executive jobs will be further inflamed by the just demands of a steadily growing number of women -- two of every three entrants to the workforce during the next decade -- and minorities for their share of leadership positions.

Professions, such as law and medicine, are being glutted by the baby-boom generation:

-- In the past 10 years, the number of lawyers in the United States grew by 83 per cent and may double in the next decade. America now has five times more lawyers per capita than West Germany, 10 times more than France, and 20 times more than Japan. The legal profession is troubled more and more by declining income, underemployment, and even unemployment (28).

-- The number of licensed physicians went from 334,000 in 1970 to 490,000 in 1984 and a projected 536,000 in 1990, when there will be a surplus of 63,000 medical doctors. Even now, only 53 per cent of American physicians in private practice are working at full capacity (29).

Not only are such professions oversupplied, but technological progress -- particularly in the advanced computer technologies labeled artificial intelligence (AI) -- may have as broad an impact on the number and quality of these jobs as robotics is having on industrial crafts. For example, researchers now are working on "expert systems" that can perform the diagnostic functions normally provided by a highly trained physician. Others are working on machines that seem to think like lawyers (30).

Some economists argue that the frustrations and fears that attend technological innovation are unfounded. In the past, they note, technological change always led to greater prosperity, wider employment opportunities, and increasingly productive work.

While the prospects for the U.S. economy as a whole are in fact bright, and the country continues to enjoy a prolonged period of economic growth, the benefits of recent national economic development have been unequal, both regionally and structurally. The turbulence of economic and social change leaves even those Americans who are currently well off with a sense of vulnerability. A symptom of this mood of uncertainty is the surprising lack of inflationary wage demands at a time of not only full employment but labor scarcity in many areas.

The outcome of these continuing changes remains to be seen. But they pose an immediate, palpable challenge to the much-heralded "American Dream" that is, in fact, a potent force in U.S. social behaviour.

CHAPTER 2

OVERVIEW OF CURRENT ROLES

Many key actors play an important role in forming and directing the American learning enterprise. The roles of the U.S. federal and state governments are obviously of great concern for policymakers. But the roles of other actors outside government are even more influential, although, unfortunately, they are far less documented.

7. The Federal Government Role

The U.S. federal government has a wide variety of programs and activities aimed at affecting the national learning enterprise. In many segments of the overall learning market, the federal role is no more than marginal, but in some specific targeted categories, federal programs are a dominant factor. Federal activities can be broadly grouped under training programs, education programs, and a variety of other activities that don't fit neatly in either of those categories.

Training Programs

About a dozen major federal programs deal directly with formal job training presented as coursework aimed at yielding some kind of vocational certification, often in combination with related activities such as: basic skills and remedial education, on-the-job training, work supplementation for grant recipients, work experience, and job search assistance (31).

Job Training Partnership Act. JTPA, established in 1983 to replace the program of the Comprehensive Employment and Training Act (CETA), provides the major federal programs for individuals with specific labor market needs. The "partnership" in the Act emphasizes that the overall JTPA program is designed to be administered predominantly by state governments in collaboration with local organizations representing the private business community. Each JTPA program has specific eligibility requirements, although an individual may qualify for service under more than one program.

Training Services for Economically Disadvantaged Youth and Adults. These programs are provided under Title II-A of JTPA. To be eligible for assistance as "economically disadvantaged," an individual must either: receive or belong to a family receiving cash welfare payments; have family income at or below a defined "poverty level"; be receiving food stamps; be a foster child receiving government support; be a handicapped adult living in poverty or on welfare. But up to 10 per cent of participants may fit other criteria of disadvantage.

In "program year" (12 months beginning each July 1) 1987, the Title II-a program spent $1.9 billion, and served approximately 800,000 persons. Nearly half of recipients were minorities and over a quarter were school dropouts. Program activities include classroom training, on-the-job training, job search assistance, work experience, and other services.

Program funds are allocated among the states according to a formula that accounts for the levels of unemployment and poverty. The state governments the use the same formula to distribute funds to local "Service Delivery Areas" (SDAs) that administer the program. The remaining funds are used for state education and coordination grants, older worker training, administration, and incentive grants and technical assistance.

Each SDA is required to establish a "private industry council" (PIC) most of whose members must represent private business. The PICs have substantial responsibility for policy guidance and oversight, and must approve the SDA's job training plan.

The federal Secretary of Labor issues performance standards to guide administration of the JTPA program that accounts for such outcomes as employment, wages, and job competencies.

Summer Youth Employment and Training Program. This program, established under Title II-B of JTPA, is designed to assist disadvantaged youth between ages 16 and 21 to obtain part-time, minimum wage work during the summer. The program, which spent $802 million in PY 1988, is authorized to provide basic and remedial education, institutional and on-the-job training, work experience activities, employment counseling, occupational training, work preparation, outreach, employability assessment, job referral and placement, job search and job club activities, and other activities aimed at helping youth to attain employment, along with necessary support services.

Employment and Training Assistance for Dislocated Workers. Title III of JTPA supports state programs to aid "dislocated workers" with job search assistance, classroom training, on-the-job training, relocation assistance, pre-layoff assistance, relocation, and other services. States have considerable flexibility in determining who is "dislocated" and what services to provide. But unlike other JTPA programs, this one requires that states match federal funds with a contribution determined by an unemployment-rate formula. The program spent about $172 million in PY 1987 to serve slightly less than 100,000 persons.

Related to this program, the Worker Adjustment and Retraining Notification Act (WARN) of 1988 requires employers under certain circumstances to give notice to state agencies and affected workers 60 days in advance of a mass layoff or plant closing. Another 1988 law, the Economic Dislocation and Worker Adjustment Assistance Act (EDWAA), modified the Title III program to speed up state response focus more effort on local training.

Native American Program. Established under JTPA Title IV, this program provides employment and training services to meet the special needs of Indians, native Alaskans, and native Hawaiians. All such Title IV programs are administered by the Office of Job Training Programs in the federal Employment

and Training Administration. In PY 1987, nearly $60 million was spent to serve 7,400 participants.

Migrant and Seasonal Farmworker Program. This Title IV program spent almost $60 million in PY 1987 to assist 46,000 agricultural workers facing seasonal unemployment and technological displacement with various employment and training services. Competitive program grants are awarded every two years to nonprofit organizations and state/local government agencies.

Job Corps. Created originally under a 1964 law and now authorized by Title IV-B of JTPA, this program offers intensive training and employment assistance, usually in a residential center, to economically disadvantaged youth between ages 16 and 21. The program expends about $600 million to serve about 100,000 people annually. Centers, run by government or labor or private organizations, provide severely disadvantaged youth such services as basic education, vocational skills training, and work experience as well as support for subsistence, clothing, health care, and recreation.

Veterans Employment and Training Service (VETS). This JTPA Title IV-C program supplements major veteran programs administered by the federal Dept. of Veterans' Affairs (formerly the Veterans' Administration). In PY 1987, $10.6 million was spent by this program to provide job search assistance, and on-the-job and classroom training to almost 15,000 service-connected disabled, Vietnam-era, or recently-separated veterans.

Vocational Education. The major federal program for vocational education is authorized under the Perkins Act, currently funded at a level of about $888 million a year, most of which is distributed to states by formula. The Act earmarks 57 per cent of funds to serve six specific groups -- handicapped, disadvantaged students, adults in need of training, single parents or homemakers -- and to programs aimed at eliminating sexual bias. States have near-total discretion in allocating funds between secondary and postsecondary education. States are not even required to report the distribution, although survey studies indicate that 60 per cent of funds are used at the secondary level.

Senior Community Service Employment Program. Established by Title V of the Older Americans Act, this program, also known as the Older Workers Program, spent $331 million in PY 1988 to provide subsidized part-time employment and training opportunities to some 90,000 persons over age 54, and aimed to place over 14,000 of these in unsubsidized permanent jobs. Participants are generally paid minimum wage to work an average of 20 hours a week in community service settings such as schools and hospitals.

Vocational Rehabilitation. Authorized by Title I of the 1973 Rehabilitation Act, this program granted $1.2 billion in PY 1987 to states for services, including training and education, to help over 917,000 handicapped persons become employable. The program distributes grants among states by formula and requires that states provide 20 per cent of total funds to match the federal contribution. Oversight of state activities is the responsibility of the Rehabilitation Services Agency of the U.S. Dept. of Education.

Trade Adjustment Assistance. Established by Title II of the 1974 Trade Act (amended in 1988), this program provides two general kinds of assistance

-- income support and reemployment services -- to workers whose jobs have been dislocated specifically by increased imports and foreign competition. In FY 1988, the program allocated $186 million for cash assistance in the form of Trade Readjustment Allowances (TRAs) to nearly 47,000 people and $54 million for such reemployment services as job search, training, and relocation for some 13,000 beneficiaries.

Refugee Resettlement Program. Administered by the Family Support Administration of the U.S. Department of Health and Human Services, this program distributed $336 million to states in FY 1987 (by formula) for services to help refugees to become economically self-sufficient as soon as possible after entry to the United States. The Program provides various services, including cash and medical assistance, social services, and preventive health services, as well as overseeing the Voluntary Agency Matching Grant Program and the Targeted Assistance Grant Program. Social services include a variety of employment and training activities. Of the 64,000 refugees admitted in FY 1987, most are believed to have received some services under this program, although the exact number is not reported.

Job Opportunities and Basic Skills (JOBS) Program. Created by Title II of the Family Support Act of 1988, this new program will replace previous "work incentive" programs and will greatly accelerate a shift in the focus of the U.S. welfare program away from income maintenance toward employment. While all states will be required to participate in this program by the end of FY 1990, 26 states will have implemented at least its provisional regulations by the end of 1989. Managed by the HHS Family Services Administration, the program aims to move recipients of Aid to Families with Dependent Children -- the nation's major and oldest "welfare" program -- to self-sufficient employment.

Among its major features, the JOBS program targets resources on those hardest to serve, especially women with young children. It emphasizes education, particularly literacy and remedial education, as well as providing training and work experience for existing jobs. The program also provides assistance with child care, to enable clients to participate in training and jobs.

Federal spending on JOBS is projected at $3.3 billion over the next five years, although actual expenditures will depend on the pace of state program implementation. HHS estimates that up to 138,000 families, or 438,000 individuals, will be enabled to leave welfare rolls over this period by the training, work placement, and increased income made possible by JOBS.

Education Programs

While federal resources may be the dominant source of support for national welfare services and job-related training and development programs, the federal government provides only about 6 per cent of U.S. funding of formal elementary and secondary education and only 12.6 per cent of formal post-secondary education funding.

At the same time, federal resources and activities in formal elementary, secondary, and postsecondary education are heavily concentrated in a few major programs (32).

SUMMARY OF GOVERNMENT-PROVIDED TRAINING PROGRAMS *

Program	Year	Federal Outlays[1] (millions)	Number of Participants Receiving: Training and Related Services	Number of Participants Receiving: Core Training
JTPA Title II-A	FY[2] 1987	$ 1,900	796,600	286,000 [3]
Summer Youth Program	FY 1988	276 [4]	628,863 [5]	n/a
JTPA Title III	FY 1987	172	98,200	27,700
Native American Program	FY 1987	27 [4] 9.8 [6]	22,108	9,501 [3]
Migrant and Seasonal Farmworkers Program	FY[7] 1987	42 [4] 18.8 [6]	18,187	6,536
Job Corps	FY 1987	34.6 [8] 73.1 [9]	103,806	103,806
Veterans' Employment and Training	FY 1987	10.6	15,000 [10]	n/a
Postsecondary Vocational Education	FY 1988	355.3	n/a [11]	n/a [11]
Senior Community Service Employment Program	FY 1987	326	66,000	n/a
Vocational Rehabilitation	FY 1985	288	110,955	32,233
Trade Adjustment Assistance	FY 1988	54.3 [12]	12,945	10,300
Refugee Resettlement Program	FY 1987	47.2 [13]	n/a	n/a
Welfare Work	FY 1987	110 [14]	48,654 [15] 170,653 [16]	n/a

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1 Program total, unless training costs are available.
2 Program year (July 1 - June 30).
3 May include basic skills education.
4 Training costs only.
5 Agency has no formal definition of training. Figures are self-reported.
6 Classroom training.
7 Fiscal year (October 1 - September 30).
8 Basic education.
9 Occupational training.
10 All program participants.
11 Number of participants may be as high as 4 million; accurate data are not available.
12 Not including TRA benefits.
13 Social service funding for priority services, not limited to training.
14 Total funding for the WIN program (including WIN Demo).
15 CWEP only.
16 Job Search only.

* from Barnow and Aron (1989)

Elementary and Secondary Education. Of the $6.6 billion of general federal support for elementary and secondary education in FY 1989, nearly $4.6 billion was distributed (by formula) through the Chapter I program of the Elementary and Secondary Education Act (ESEA) which provides financial assistance to local school districts for "compensatory education" for disadvantaged children and to state educational agencies for special services for children of migrant workers, handicapped children in state-supported programs, and neglected or delinquent children under state care. Altogether, the Chapter I program served some 5.6 million children. (About 40 million children are enrolled in U.S. K-12 schools.)

The next largest funding categories are Special Education ($1.96 billion in FY 1989) and Rehabilitative Services ($1.66 billion in FY 1989). In this area, the Education for the Handicapped program provides formula grants to states to help support public education and related services for handicapped children from age 3 through 21. Other grants to states support education and other services specifically for preschool children. Special funds support research, demonstration, and training activities and a number of specific projects and programs. About $100 million is allocated to support several special institutions serving the handicapped, including Gallaudet University, which offers a full range of educational programs for the deaf.

The other major federal K-12 education activity is the ESEA Chapter II program most of which -- $463 million in FY 1989 -- goes to a State Block Grant Program that provides relatively flexible funding for efforts to improve the quality of elementary and secondary education.

One more large spending category is Impact Aid -- $733 million in FY 1989 -- designed to compensate local education agencies for the increased enrollment or loss of local tax revenues resulting from the presence of major federal facilities such as military bases.

Post-secondary Education. Over 92 per cent of the $9.76 billion of federal FY 1989 post-secondary education program budget went to provide financial aid to students through a half dozen major grant and loan programs. These programs aided about six million students via some 10 million awards. The remaining funds were allocated to institutional aid and several special programs.

Other Programs

Of relevance to OECD's special interest in "further" education for adults is the federal government's support for basic education to combat adult illiteracy. Some 40 million American adults lack the basic knowledge and skills desired of a high school graduate -- about the same as the number of children enrolled in K-12 schools. A government study identified 79 literacy-related programs administered by 14 federal agencies, and spending less than $350 million in FY 1985. In most of these programs, literacy was a secondary or indirect concern. The federal Education Department's adult education program spent $162 million in FY 1989, mostly on grants to state and

local agencies. This level of investment should be compared to the $200 billion in total national spending and roughly $10 billion in federal aid allocated to basic education for children.

With a trillion-dollar annual budget, millions of employees, and thousands of agencies and programs, it is certain that the federal government affects the overall U.S. learning enterprise in many ways other than the explicit programs noted above. For instance, the U.S. Defense Department is the world's largest educator/trainer, spending nearly $20 billion annually to provide formal instruction to the equivalent of over a quarter million full-time students. And this does not reflect the third or so of the Department's $300 billion budget that entails the cost of continual "training" in peacetime for military preparedness.

8. The State Government Role: A Case Study

To fully understand how government manages the learning enterprise in America, the focus must be on the states. The federal government provides less than nine per cent of the public financing of formal education -- kindergarten through university. In the United States, 90 per cent of the elementary and secondary school enrollment is in public schools that receive about half of their funding, on average, from the state governments. Since the local governments that provide most of the remaining funds, and administer the schools, are constitutionally creatures of the state, the state government has the dominant responsibility for public education. About 80 percent of the higher education enrollment in America is in public institutions, most of which are funded and operated by the states. Not only do the states therefore have the central government role in education, but education in turn makes the largest claim on state revenues. Over 40 per cent of state budgets go to support education, on average, and in many states the portion is over half.

Public investments in job training, adult basic education, and similar categories outside formal education are more evenly divided among federal, state, and local authorities. But the total of these expenditures shrink to near insignificance next to the vast public resources allocated to schools and colleges in the United States. All things considered, any chart of the American learning enterprise will show that the states are where the main action is.

How the states manage their investments in education, training, and other forms of human resource development can be best understood here by focusing on a single state. What follows is derived from a pilot study of the entire "portfolio" of investments that one state government -- in this case, Colorado -- makes in human capital (33).

Some 18 Colorado state agencies or programs have a significant role in human capital investment; of these, 16 support or provide education and training activities (34). They include:

-- Elementary and secondary school (K-12) programs of the state Department of Education.

-- Four-year college and university institutions overseen by the Colorado Commission on Higher Education.

-- Colorado Community Colleges and Occupational Education System (35).

-- Governor's Job Training Office, which administers the federal JTPA program.

-- Job Training Co-ordinating Council, a state-level committee which provides oversight of the JTPA program.

-- Office of Library and Adult Services, in the state Education Department, which runs the very small adult basic education program.

-- Employment and Training Division of the state Department of Labor and Employment, which administers the federal TAA and TRA programs for displaced workers, and oversees the federal Job Corps program for disadvantaged youth.

-- Colorado FIRST Customized Training Program, a state-funded program which trains workers to perform specific jobs for a particular company (36).

-- Co-operative Extension Service, a partnership of federal, state, and county agencies which provides not-for-credit educational programs in the areas of agriculture and natural resources, and home economics and family living (37).

-- Educational services provided by the Colorado Department of Institutions, including a vocationally-oriented Developmental Disabilities program for handicapped (mainly adult) persons (38).

-- Rehabilitation Services of the Colorado Department of Social Services, which assist physically or mentally handicapped persons to become employable and independent.

-- Educational activities of the Colorado Health Department, which generally involve training health, environmental protection, and law enforcement personnel (39).

-- Department of Corrections programs to provide vocational training and basic education to prison inmates.

-- Personnel Department responsibilities to establish educational requirements for jobs and to provide training for state government employees (40).

-- Traffic Safety program of the Colorado Highways Department, which trains police officers to handle highway accidents and "DUI" (driving under influence of alcohol/drugs) violations.

-- Aid to Families with Dependent Children, the main "welfare" program administered by the state Department of Social Services, which has become increasingly oriented to employment training rather than just income maintenance, as a result of both state initiatives and creation of the federal JOBS program (41).

-- Division of Registrations of the Department of Regulatory Agencies, which includes 22 professional and occupational licensing boards that, while not providing education or training themselves, serve to define training requirements for the practice of a variety of vocations (42).

Some of the notable characteristics of the Colorado state government's human capital investment portfolio are these:

-- The vast majority of spending is in the three traditional areas of state interest: K-12 education; higher education; and the community colleges and occupational education system. The combined budgets of these three programs account for 58 per cent of the state general fund budget, and one third of total state appropriations.

-- All other education/training programs combined account for 1.6 per cent of general fund appropriations, or about 2 per cent of total state spending.

-- Local governments spend an amount about equal to state spending, mostly in the K-12 category.

-- Federal funds for education/training in Colorado are less than 6 per cent of the total spent by state and local governments, but often constitute the major or even sole source of funding in specific targeted areas, such as job training for unemployed/disadvantaged populations.

This project could not study the private sector in Colorado, but national data imply that education/training investments by private employers (including military) in the state are probably between 30 per cent and 40 per cent of the amount spent by state and local governments (43).

COLORADO "PORTFOLIO"--STATISTICS (x 1,000) FY 1987

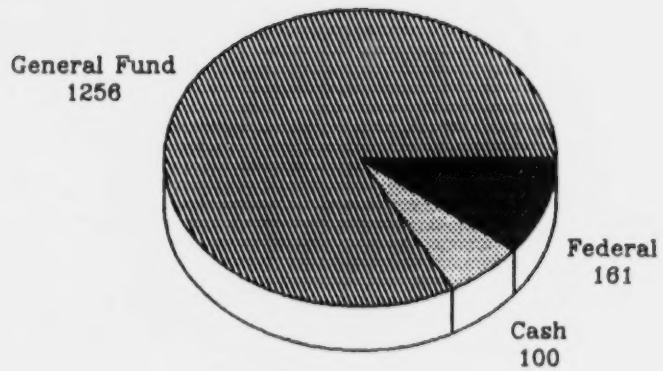
program	GF	CASH	FED	ALL FUNDS	LOC	pop. served
ED./K-12*	921,776	-	100,052	1,021,828	1,322,444	536.0
HIGHER ED.	223,332	64,766	-	288,098	-	110.0
CCCOES	77,546	30,069	5,389	113,004	46,702	106.0
JTPA (GJTO)	-	-	28,091	28,091	-	26.5
LIB./ADULT SERV.	50	-	1,371	1,421	-	22.4
CDLE/EMP. & TRAIN.	-	-	1,019	1,019	-	1.8
COLO. FIRST	836	-	-	836	-	1.5
COOP. EXTENSION	6,000	900	4,000	10,900	6,500	1,800.0
INST'NS/DEV. DIS.	16,425	-	-	16,425	-	5.6
CDSS/REHAB. SERV.	2,511	-	10,042	12,553	-	17.5
HEALTH	4,725	4,975	11,220	20,920	-	1.0
CORRECTIONS	3,359	60	100	3,519	-	2.7
PERSONNEL	130	-	-	130	-	50.0
HIGHWAYS/TRAF. SAFE.	-	-	98	98	-	.8
Human Capital TOTAL	1,256,690	100,770	161,382	1,518,842		
Other St. Approp'ns	850,786	1,123,300	755,902	2,729,988		
Total St. Approp'ns	2,107,476	1,224,070	917,284	4,248,830		
Hum. Cap./State (%)	59.6%	8.2%	17.6%	35.7%		

* Calendar Year 1987 data; Fiscal Year 87 total funds for Colo. Ed. Dept. were about 15 million more.

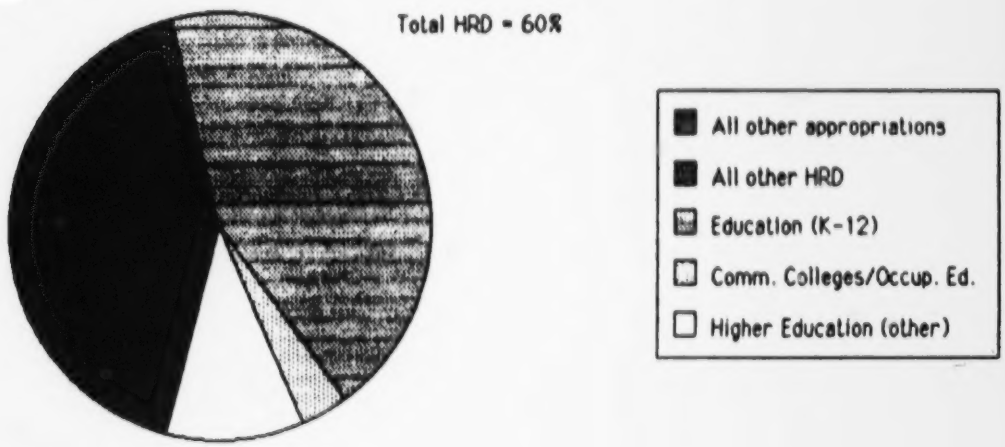
Colorado HRD "Portfolio"

DISTRIBUTION OF FUNDING SOURCES

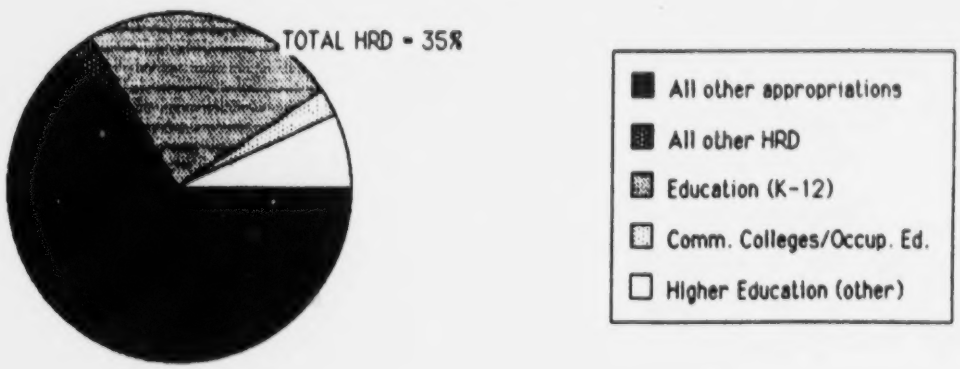
($ x 1 000 000)



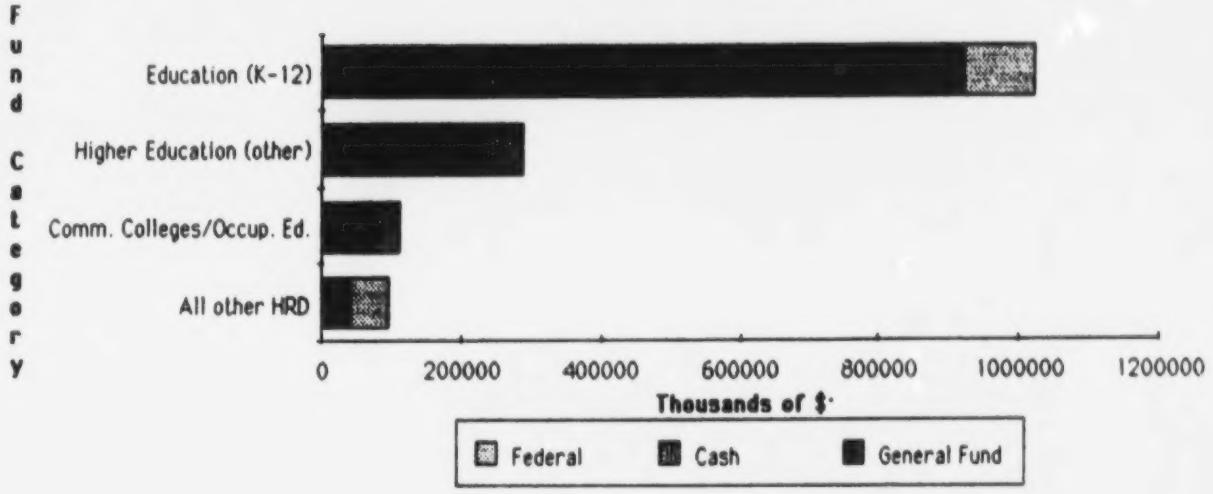
Colorado Human Resource Development (HRD) Portfolio
HRD APPROPRIATIONS AS A PROPORTION OF GENERAL FUND APPROPRIATIONS - 1987



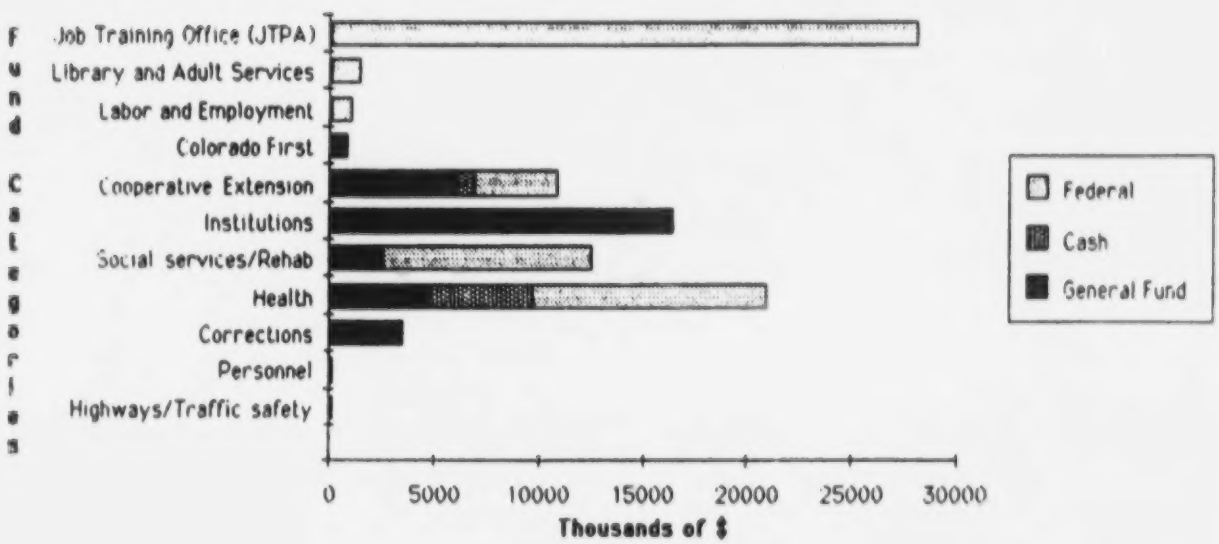
Colorado Human Resource Development (HRD) Portfolio
HRD APPROPRIATIONS AS A PROPORTION OF TOTAL STATE APPROPRIATIONS - 1987



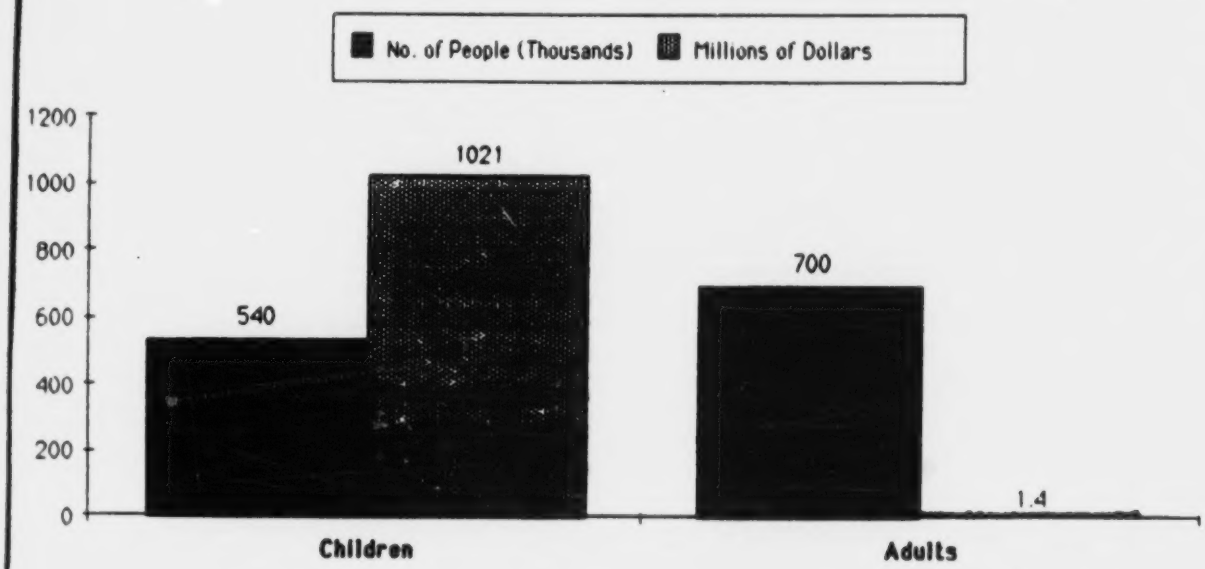
Colorado Human Rousource Development (HRD) Portfolio
APPROPRIATIONS BY CATEGORY OF FUNDS BY HRD
EXPENDITURE, 1987



Colorado Human Resource Development (HRD) Portfolio
APPROPRIATIONS FOR "OTHER" HRD PROGRAMS
BY CATEGORY OF FUNDS - 1987



PRIORITIES OF STATE INVESTMENT IN ADULTS VS. CHILDREN NEEDING BASIC EDUCATION



Quality of the Investment Portfolio

From the empirical information about the state's programs and budgets, and observations made in the course of the study, four key conclusions follow about the value of the portfolio as a system of investment in economic development:

1. There is an acute imbalance in the distribution of resources in the state portfolio and the priorities of economic development. In particular, the learning and development needs of the current adult workforce are underserved. At a time when unskilled jobs are rapidly vanishing, and the majority of new jobs (or new requirements of old jobs) demand knowledge and skills beyond that required by a high school diploma, about 700,000 Colorado adults, representing around 40 per cent of the state workforce, lack the literacy and basic education expected of a high school graduate. Yet over 99.9 per cent of government expenditures for basic education are targeted on the less than 550,000 school-age children in Colorado.

The imbalance in public investment in human capital is apparent at the other end of the age spectrum as well. While research has demonstrated convincingly that investments in early childhood development and preschool education pay rich dividends, investment in the care and development of preschool-age children generally has not kept up with the needs of children in poverty or with working parents. The federal Head Start program is funded to serve only about 20 per cent of eligible children. Preschool children receive only about one percent as much state investment in their education as school-age children do.

2. There is little or no accountability to the state government, and hence to the state taxpayer, for the achievement of specific results from expenditure of the nearly 60 cents of every general fund dollar and the over one-third of all state spending allocated to education and training. Such accountability that does exist, usually in the name of "accreditation" or "certification," focuses almost exclusively on inputs rather than outcomes. That is, these accounts only inform the consumer how much and what kind of resources have been put into the education process, but not what they are good for or even, for that matter, whether they are good for anything.

Accountability for outcomes is found in some of the training or non-formal human resource development programs in the state portfolio. The JTPA program, by design, has rather strict accounting for its intended result: employment of trainees. The occupational part of the community college curriculum is competency-based, and several other specific services, such as adult literacy or rehabilitation, focus on achieving specific, measurable outcomes. But these comprise only a few percent of the investment funds. The vast majority of the state's human capital investment portfolio is invested in institutions that, for all practical purposes, are not accountable for results.

3. There is an overwhelming absence of consumer choice and competition among the providers of education, training, and related services. Virtually all public investments in education and training in Colorado are allocated to government owned and operated institutions -- whether elementary and secondary

or postsecondary -- that control over 90 per cent of their markets, and that are constrained by statute or administrative policy from competing to serve consumers.

4. As a result, the productivity of government investments in human capital development is severely limited. The combination of a delivery system structured as a government monopoly, lack of accountability for achieving specific results, and absence of consumer control of resources gives professional providers little direction or incentive, other than altruism, to improve consumer service or to reduce costs through greater technical efficiency. Instead, education and training policies in Colorado, as elsewhere in the United States, continue to operate on the assumption that doing more requires spending more.

Colorado's Relative Position

There is an inevitable desire to know what these findings imply about Colorado's standing and performance in relation to other states. In general, Colorado ranks about average or above average among states on such broad and common indicators of educational investment as dropout rates, test scores, graduates, spending on K-12 or higher education, and so forth. But since no comparably broad study has been made of any other state's detailed human capital investment portfolio, the Colorado portfolio cannot yet be compared directly to other states'.

Also, the map of one state's total investment portfolio is no more likely to be "typical" of other states than a highway map would be typical. Colorado, like every state, is a special place, with unique cultures, traditions, institutions, goals, opportunities, and people.

Nevertheless, many of the problems of the human capital investment system in Colorado afflict other states and the United States as a whole.

9. Non-governmental Roles and Activities

In attempting to chart the American learning enterprise, and its impacts on human capital, careers, and economic performance, the further one gets from the kinds of well-defined government training and education programs described above, the less visible the enterprise becomes.

The obvious programs and institutions for education and training of all kinds -- especially those that serve and engage the adult population -- are truly just "the tip of the iceberg." As this common metaphor accurately emphasizes, nine-tenths of the true mass of the object at hand lies below the surface, hidden from view.

A central problem for both public policy and the efficiency of the learning market is that most of what is documented about learning in America is obsolete, incomplete, or unrelated to the new shape of the learning enterprise in the modern economy. Alternatively, most of the important dimensions of this large and new enterprise are so far undocumented.

To put these obscure but vital elements of the U.S. learning enterprise in perspective, it will be useful first to review the shape of the formal education system.

Formal Education

Public elementary and secondary education in America enrolls about 40 million students in some 85,000 schools administered by nearly 16,000 local school districts; some 20,000 private (44) schools enroll less than 6 million additional students. America's elementary and secondary schools employ about five million people at a current cost of $200 billion annually -- the highest expenditure per student of any industrialized nation. Some 25-30 per cent of students drop out of school before graduating from high school; of those who do graduate, about 50 per cent go on to enroll in higher education.

The extent to which elementary/secondary schools serve adults with basic education needs varies widely from place to place in the United States. In Colorado, as noted above, there is virtually no public investment in adult basic education through the K-12 system; local public schools receive no state aid for enrolling students over the age of 18. In Michigan, on the other hand, a substantial portion of elementary/secondary education funds is allocated to serving adults. The Arlington County, Virginia public school system actually enrolls a larger number of adults than children -- the community has a large immigrant population needing English and other basic skills training that the district has committed itself to serve.

Formal post-secondary education costs another $130 billion a year to serve about 13 million students through over 3,300 colleges and universities that employ about a million people. While the numbers of public and private colleges are about equal, nearly 80 per cent of enrollment is in public institutions. About 37 per cent of total enrollment is in community and junior colleges. The latter nominally offer 2-year academic programs, but in practice only a few per cent of enrolled students ever earn degrees -- most seek remedial education and/or vocationally relevant training.

A significant part of the work of these "higher" education institutions in America is simply to remedy the deficiencies of elementary and secondary education: Of about 2.3 million freshman entering college in 1984, 16 per cent enrolled in remedial reading courses, 21 percent took remedial writing, and 25 per cent needed remedial math. Between 1978 and 1984, 63 per cent of American colleges reported increased enrollment in such remedial classes.

Furthermore, U.S. post-secondary education is increasingly a mid-career activity. In 1970, roughly half of college students were in the 18-24 age group; today less than a third are. Since 1982, more than half of all U.S. college students have been female. And since 1970, part-time students have gone from representing less than a third of enrollment to nearly half, about 45 per cent (45).

But the biggest part of the learning enterprise is comprised of less formal, not-so-obvious and even nearly invisible elements.

Employers

The investment made by U.S. employers in structured, classroom kinds of education and training for their workers is estimated to be at least $30 billion a year. But because the organization, accounting, and budgeting of these activities vary from firm to firm, and no formal reporting requirements or even standard surveys exist, the estimate is barely more than a guess.

The cost of time and effort involved in less structured, so-called "on the job" training in America is extremely difficult to gauge, but is widely believed to be something in the range of $200 billion to $300 billion a year, or perhaps more (46).

The Commercial Sector

An important sector of the U.S. learning enterprise, and one not often recognized or well understood, is comprised of organizations that sell instructional services or products commercially. Many are "proprietary" -- that is, for-profit -- although some are not-for-profit that nevertheless function more like businesses than like academic or social institutions.

The group in this sector most obviously connected to workforce training and education are so-called "noncollegiate" vocational, trade, technical, and business schools, most of which are proprietary. Training in a wide variety of skills and occupations is offered by such schools, including cosmetology, secretarial, computer programming, truck driving, flight, drafting and design, and health services. Statistics describing these institutions are, unfortunately, dated and imprecise.

According to Carnevale and Johnston (1989), private vocational schools in 1985 were training more than two million people -- 2.2 per cent of all workers -- while their public counterparts were training about 1.5 million employees -- 1.6 per cent of all workers -- to qualify for jobs. In 1982, such proprietary schools represented nearly two-thirds of the post-secondary schools with occupation programs listed by the federal Education Department. Revenues, reported at $2.5 billion in 1973, are certainly much larger today.

Most schools are small and narrowly focused. The average business or secretarial school enrolls 314 students; the average trade school, 157 students; and the average cosmetology school, 62 students. Many of these small schools nevertheless are operated quite profitably by large chains, notably: National Education Corp., DeVry, and Control Data.

Nearly half of the proprietary schools are accredited by one of three associations (ASICS, ACCE, or NATTS). Some also are accredited by regional higher education associations and offer college degrees.

In terms of sheer numbers, the proprietary school sector is the largest in the United States, with more than 6,000 residential schools (excluding correspondence programs) representing about two out of three postsecondary vocational institutions, enrolling three-quarters of the students in such institutions in 1982 (47). A recent study by Shearson Lehman Hutton found that, while post-secondary enrollments overall have grown less than

one per cent in the United States since 1980, enrollment in proprietary trade schools has grown as much as 13 per cent a year. Another study in 1988 indicated that 1.6 million students attended 4,225 accredited private career schools, accounting for 15 per cent of post-secondary enrollment (48).

The growth of proprietary schools has been marked by controversy over their cost and effectiveness. The share of federal post-secondary education grant funds going to proprietary schools has more than doubled from 11 per cent in 1980 to 27 per cent in 1988; the schools' share of federally guaranteed student loan funds also has grown. Yet loan default rates for proprietary schools is reported at 40 per cent, twice the rate of two-year institutions, and four times the rate of four-year colleges.

A study by Stanley Litow, head of a research organization called Interface, of 312 New York City proprietary schools concluded that only 35 per cent of students who began a course of study successfully completed it, and of those, 64 per cent were employed in the field they were trained for. On the other hand, a study by consultant John Lee, which compared a survey of 1980 high school seniors with their status six years later, found that 65 per cent of those who had attended proprietary schools had a earned a certificate or degree -- the same figure for those who attended four-year institutions and more than the 45 per cent of community college students receiving a degree or certificate. At the same time, Lee found that the annual salaries of full-time workers who had attended proprietary schools were slightly higher -- $16,000 -- than those for workers who had attended community or four-year colleges -- $14,000 (49).

While proprietary schools long have been active in post-secondary education in the United States, in recent years the role of commercial organizations in the elementary and secondary sector has been growing rapidly. Proprietary organizations such as Sylvan, Huntington, Brittanica, and Kindercare have hundreds of centers throughout the United States providing supplementary education for underachieving students in basic skills such as reading and mathematics. Most of these organizations promise grade-level advances in as little as 30 days, and even offer guarantees.

Proprietary organizations also are increasingly providing instructional services in public elementary and secondary schools in specialized subjects where qualified teachers are often lacking. Berlitz, for instance, provides foreign language classes in a number of public schools, and other companies contract with school districts to teach biology and other science courses.

Commercial companies not only provide the large volume of books and other publications used in instruction, but a growing variety of other products and services, from standardized tests, to test grading machines, to computer- and video-based equipment and software, and even to "latchkey" integrated learning systems.

The "Hidden Matter"

The great majority of learning in America, by both children and adults, takes place outside of formal instructional settings. Because all knowledge is intimately if not universally connected, and because there is virtually no research linking the economic outcome of a particular form of knowledge or

skill to all of the sources through which it was learned, there is no reason to assume that the contributions of the learning enterprise's "hidden matter" are any less economically valuable than those attributed to formal instruction.

Parts of the hidden matter are evidently similar to the structured forms of education and training. A 1984 survey indicated that 23 million American adults participated in adult, continuing-education, or noncredit courses, the majority of which were offered by employers, unions, neighborhood centers, churches, and community groups.

But conferences, meetings, seminars, and conventions hosted in hotels or special conference centers are rarely thought of in the United States as part of the nation's "further education," despite the facts that the communication processes involved are similar if not identical to college colloquia, the programs involve annually about as many people as colleges do, and the funds involved -- about $70 billion a year -- are about the same as the total revenues of 4-year colleges.

Other huge segments of the learning enterprise are almost never recognized much less accounted for, in spite of their palpably vast impact on Americans' knowledge, attitudes, and behavior. Advertising is a $100 billion business in America employing state-of-art science and technology to educate consumers. The social and economic influence of broadcasting, film, and audio and video recorded media -- of which explicitly "educational" programs are a fairly minor though not unimportant share -- would seem impossible to overlook: In the course of a lifetime, the average American will spend the full-time equivalent of nine years in front a television set but only three years in classrooms.

Cable television, now available in half of U.S. homes, offers a multitude of new information channels, many targeted on special interests. One cable network, C-SPAN, transmits continuous, full coverage of the proceedings in the chambers of the U.S. Congress. The Discovery Channel, a cable network specializing in documentary and educational programming, has grown in five years from a $25-million start-up to a $300-million business serving some 40 million U.S. households. The Learning Channel was started by the National Aeronautics and Space Administration and became a private company that now sells instructional television programs to over 900 U.S. cable TV systems.

Psychological counseling and psychotherapy are essentially educational processes that not only engage millions of people and billions of dollars in the United States, but that are increasingly relevant to manage the stresses of a restructuring workforce and workplace -- a recent study, for instance, found that 25 per cent of the business workforce may suffer from anxiety disorders or stress-related illness, with about 13 per cent suffering from depression (50). Recreation, entertainment, sports, and a host of other social activities make immense and vital contributions to the American learning enterprise yet are commonly unappreciated or erroneously dismissed as frivolous.

Whatever America's illiteracy problem may be, the fact remains that the country's multibillion-dollar publishing industry -- which introduces 50,000 new books each year along with a burgeoning array of special-interest magazines and other periodicals -- is still a prodigious channel delivering knowledge and skills directly to the learning consumer. To cite just one of countless

notable examples: Dr. Benjamin Spock's famous book, Baby and Child Care, in print since it was first published in 1946, has been translated into 39 languages and bought by 37 million parents. "Its influence on 20th-century middle-class child-rearing," a Washington Post reviewer recently noted, "has been, quite literally, incalculable (51)."

Embedded Training

What may be the most signficant, and is likely the fastest-growing, segment of the learning enterprise's "hidden matter" is the broad category of training and learning systems that are embedded in a variety of products and production systems. The simplest and most obvious is the huge array of instruction manuals that are packaged and sold with products ranging from microwave ovens to aircraft carriers. Increasingly, the functions provided by traditional paper manuals are being automated and replaced by "on-line" systems using help screens, hypermedia, telephone "hotlines," computer-based expert systems and intelligent tutors, and telecommunications networks.

For instance, studies of how Americans learn to use computers indicate that skills are acquired mainly by trial-and-error, on-line help screens, supplementary ("how-to") texts, manuals, informal consultants and peers, telephone hotlines, and packaged tutorials, with formal classroom training playing a relatively minor role. And most classes are taken from independent or third-party proprietors, not academic institutions (52).

The Learning Curve

In its simplest form, the "learning curve" -- sometimes also referred to as the "experience curve" -- is an industrial engineering graph which shows that the efficiency of a production process increases as working experience with the process grows. Yet the phenomena of learning-by-working that the learning curve represents may be both the most mysterious and most valuable forms of the learning enterprise's hidden matter.

The learning curve is one of the most crucial contributors to productivity growth, and hence to both corporate and national prosperity. Yet the mechanics of learning through experience, and of its cousin, on-the-job training, are mostly uncharted and poorly understood.

The economic value of the learning gained from business experience is hinted at by recent reports of two Japanese acquisitions of U.S. firms. Reporting on the $1.4 billion deal by which Dai-Ichi Kangyo Bank (the world's largest) acquired a major share of CIT Group Holdings and a substantial interest in Manufacturers Hanover Corporation, The New York Times concluded that the major objective of such acquisitions is expertise:

> "...[A]s Japanese banks...push into foreign markets, the most precious commodity seems to be not money but knowledge of the new markets and new business methods.

> Analysts say that the Japanese banks are paying dearly for this financial technology, and that their ability to learn is likely to make the difference in how well they compete internationally" (53).

Similarly, a Washington Post report that Japan's Tokyu department store chain was negotiating a $1.3 billion deal to acquire America's famous Bloomingdale's stores attributed the Tokyu bid to the Japanese firm's hunger to learn the secrets of Bloomingdale's way of doing business:

> "They study the clothes," Bloomingdale's spokeswoman Miraed Smith said of its many Japanese visitors.... "They study the displays. They study the windows. They are curious about our cash registers, our inventory control. I would say there is nothing about Bloomingdale's that they're not interested in (54)."

Satisfying that curiosity commands a high price because Bloomingdale's protects the expertise learned from decades of experience: even photographs are prohibited in its stores.

The catalogue of such hidden matter could be extended indefinitely. But the inescapable conclusion is that not only the mechanics but the sheer scope not merely of "further education" but of the learning enterprise as a whole in America so far have gone unaccounted.

CHAPTER 3

PARADIGM GAPS

The conceptual framework, or paradigm, within which the American learning enterprise traditionally has been envisioned is now hopelessly obsolete. The old paradigm equates learning with schooling and emphasizes the passivity of the student as an object of instruction. The emerging new paradigm portrays learning as an active, intransitive process permeating production technology as well as social behavior.

The persistence of the outmoded paradigm is spawning growing gaps in the creation and adoption of potent new heuristic technology; in the measures and accounts of the learning enterprise's true performance; and in both public and private policies that govern this huge and strategically vital sector of the American economy.

10. The Technology Gap

The cardinal symptom of economic malaise in the existing U.S. learning enterprise is egregiously poor and declining productivity. This productivity crisis stems directly from the willful resistance of the educational institutions that control about half the learning enterprise's resources to creation and adoption of new technology for learning and teaching.

Education's Productivity Crisis

The four-year study by the U.S. Congress' Office of Technology Assessment noted above (Kelly, 1988) concluded that the key obstacle thwarting America's shift to an information age economy is the egregiously poor productivity of the education sector. In particular, OTA found that education is tied (with social work) as the most labor-intensive business in the economy, with labor costs equal to 93 per cent of output value, compared to an average of about 54 per cent for all U.S. business. In the high-technology telecommunications industry, labor-intensivity has declined from over 52 per cent in the mid-1950s to less than 42 per cent today.

Education's productivity is not only poor but declining. Since 1950, the real dollar (inflation-adjusted) cost of elementary/secondary (K-12) education in the United States has quadrupled. College is no better bargain: The price tag for higher education doubled in the last decade as costs grew much faster than inflation.

Costs zooming upward, enrollments staying the same or declining, and the quality of the output of schools and colleges either staying as good (according to their fans) or deteriorating (according to their critics) altogether mean that educational productivity -- in terms of the ratio of effectiveness to cost -- has been going sharply downhill.

The immediate cause of this poor performance is education's gross lack of investment in technology. OTA's study revealed that education has by far the lowest level of capital investment (another name for "buying technology") of any major industry: only about $1,000 per employee. The average for the U.S. economy as a whole is about $50,000 of capital investment per job. Some high-tech industries invest $300,000 or more in technology for each worker. Even other, relatively labor-intensive, "service" businesses provide at least $7,000 to $20,000 worth of equipment and facilities for each employee.

This is a good place to call attention to a unique characteristic of the education industry, or learning enterprise, that sets it apart from all other businesses, and that makes the above and other unflattering comparisons even worse. That is: Education is the only business where the consumer does the essential work. To the extent that learning is education's essential (though not only) business, it's clear that the productivity of the student or learner -- not teachers or administrators -- is what really counts.

If we count the student, rather than the paid staff, as the "worker" to be compared to workers in other sectors, education's productivity/technology gap looms even larger. Thus, the public schools' niggling capital investment of $1,000 per employee becomes a pathetic $100 per worker if worker means student. As a matter of fact, while the average U.S. public school budget now comes to about $5,000 per student annually, the typical school district expends only about $100 to $200 of that exorbitant sum on materials and tools for each student to use directly for learning.

In a world where life cycles of product and production technology now are measured in months rather than decades, scanty capital investment inevitably leads to creaking technological backwardness. So we should be dismayed but unsurprised to observe that -- in the midst of a global information revolution -- the instructional technology available to most students, most of the time, in most American schools and colleges today ranges from 100 to 1,000 years old. While the power of information technology has been leaping upward by factors of 10 every few years since the 1950s, a report a few years ago by the late Ithiel Pool of MIT (55) found that classroom instruction was the only one of some two dozen communications media studied whose productivity sharply declined during the past two decades.

Had the power of educational technology (not in some laboratory but in common use) grown at the same pace over the last four decades as the power of computer technology, a high school or college diploma -- which still take 12 and 4 years respectively to produce, at an average cost for either of about $60,000 -- could be produced in less than 10 minutes for about five cents!

The point is not that America should expect instant education for a nickel tomorrow. But this comparison demonstrates that the technological gap between the school environment and the "real world" is growing so wide, so fast that the educational experience is at risk of becoming not merely unproductive but increasingly irrelevant to normal human existence.

The R&D Gap

Compared to any other part of the modern economy, the minuscule share of the education industry's vast financial resources invested in research and development is shocking. While the federal government pays less than 9 per cent of the national bill for formal education (school and college), it pays for most of the educational research. Depending on what one counts as "R&D," the federal Education Department spent between $136 million and $388 million on some kind of research in the 1989 fiscal year. Only about a million dollars of this was devoted to development of advanced instructional technology (56). Most of the research on high-tech teaching and learning is financed by the Defense Department, to the tune of about $200 million annually. The National Science Foundation also allocates about $15 million a year to research on innovative instruction for science and mathematics (57).

These hundreds of millions of dollars may sound like a lot of money for research until one considers the scale of the nation's learning enterprise. The education and training sector is America's largest information industry and, depending on what is counted, may be simply the country's biggest business. Formal instruction provided by schools, colleges, and corporate and military training departments is about a $400 billion a year industry; OTA estimates it employs around 10 per cent of the U.S. workforce. When on-the-job training and other less visible but no less economically significant forms of teaching and learning are included, the learning enterprise is over a $500 billion business, and may even equal the $600 billion health care industry (generally viewed as the biggest).

By OTA's accounting, the education sector's investment in R&D comes to only 0.025 per cent of its annual revenues. Even if demonstration projects, program evaluations, and other activities plausibly considered "research" are included, education's R&D spending still is less than 0.1 per cent of revenues.

In contrast, R&D accounts for 2.5 per cent of the entire U.S. gross national product. The average American business firm invests 2 per cent of sales in R&D. But in high-tech, information-based businesses -- the kind of business education ought to be but isn't -- companies commonly plow 7 per cent to 20 per cent of their sales into R&D. For instance, in Business Week magazine's latest "R&D Scoreboard" the five top-rated companies in the computer software and services sector (the fastest growing segment of today's computer industry) spent 26.9 per cent, 17.2 per cent, 17.9 per cent, 16.1 per cent, and 28.6 per cent of their revenues on R&D.

But Business Week's recent research revealed that it is the amount of R&D investment per employee that is the most powerful predictor of business success. By that standard, the magnitude of the education sector's failure to invest in innovation is magnified because education, being so labor intensive, dilutes its already piddling R&D expenditures over a relatively larger workforce than other businesses.

For the formal education sector (kindergarten through university), R&D spending per employee is less than $50 a year. Now consider what each of those leading companies in the computer software and services business spend annually

on R&D per employee: $42,622; $36,207; $33,535; $30,389; and $30,264 (58). The composite figure for all the companies in all the industries rated by Business Week is $5,042 of annual R&D investment per employee (59).

As meager as $50 a year for education's per-employee R&D investment appears, it's instructive again to recall that the student is the "worker" whose productivity matters most in the education business. So the education sector's annual R&D investment per worker realistically is something less than $5 -- a thousand times less than the norm for other major industries, and **ten thousand times less** than the amount spent by the most competitive U.S. firms in high-tech, information businesses.

The Innovation Gap

Clearly, a bold initiative is urgently needed to close education's disastrous R&D gap. But before getting to specific proposals to solve that problem, it's essential to recognize that merely adding dollars to the educational research budget will not, by itself, lead to more innovation or greater productivity in the nation's schools and colleges.

The failure to effectively exploit the instructional power of the computer is just one notable illustration of educational institutions' capacity to resist change. A decade and a half into the "desktop computer" revolution, 40 million personal computers are in use in the United States. Computers called "computers" are in some 20 million American homes. But nearly 30 million U.S. homes have Nintendo "game" units -- computer terminals masquerading as toys.

In contrast, another OTA report (Roberts, 1988) found that U.S. schools have spent a total of about $2 billion on instructional computers over a period of ten years -- that's only a tenth of what the rest of America spends on personal computers every year. A recent survey by Henry Jay Becker of Johns Hopkins University determined that there are about two million instructional computers in K-12 schools, only about one for every 20 students on average (60). Many of the computers counted as "present" in schools are old, obsolete, or simply locked away, unused. While experts have concluded that, ideally, all students should get to use instructional computers for about a third of their time in school, or 10 hours a week (61), the OTA report estimated that students typically get to use computers in U.S. schools only about one hour a week.

There is little mystery about the broad reasons for the failure of schools and colleges to adopt computers and other technological innovations or about what needs to be done, in general, to remedy these institutions' resistance to progress.

The key reasons for the lack of adoption of productive technological innovations in U.S. pre-college education lie in the combination of incentives and disincentives common to government-owned, bureaucratically administered, monopolistic enterprises.

In essence, the public school is America's collective farm. Innovation and productivity are lacking in American education for basically the same

reasons they are scarce in Soviet agriculture: absence of competitive, market forces.

The public school normally provides, at best, no incentive -- other than altruism or curiosity -- for practitioners to adopt innovations. A teacher I interviewed for a recent study of the use of computers in public schools put it succinctly: "Why should I do anything different next year from what I did last year?" In fact, scarcely any schools, even those that aspire to be progressive, offer any substantive reward, or even opportunity, for professional staff to adopt productive tools.

At worst, and commonly, the typical school environment is pregnant with disincentives for innovation which, over a period of a half century or more, have proven highly effective in preventing or reversing technological change in education.

For instance, journalists and other education analysts commonly cite lack of teacher training as a barrier to adoption of instructional computers. Yet training, by itself, cannot overcome bureaucratic disincentives. Indeed, training may even prove counterproductive.

The Houston Independent School District, for example, until this year provided an intensive, 300-hour teacher training course in the effective use of instructional technology (62). Yet graduates of the program -- the most innovative and technically proficient teachers in the district -- who practiced what they learned actually got negative grades on a state-imposed teacher evaluation instrument that values "teaching" according to the ability to stand in front of a blackboard and talk, rather than the ability, or even willingness, to employ modern, student-centered tools. Staff in the district reported (63) that many of the best-trained teachers were leaving the system for jobs where their skills were in demand and rewarded.

Despite apparent institutional differences, the barriers and disincentives for innovation in higher education are broadly similar to and equally effective as those that hobble K-12 schools. The list of such obstacles could be extended indefinitely. But the vast majority stem from the bureaucratic structure of the formal education system, not, as some "experts" claim, from inadequate technology or lack of government subsidies.

In contrast to the situation in schools and colleges, demand for computer-based instruction is strong in the unregulated and unsubsidized market for employer-provided education. It is estimated that some 30 per cent of the more than $50 billion employers invest annually in employee training is spent on computer-based instructional systems (64) -- that is over seven times more in one year than public schools have spent on instructional computers in the last ten years. Or, to look at the same data from another angle, employer-provided education invests a 300 times larger share of its total budget in computer-based instruction than public education does.

The failure to consider the total market for instructional computing and other advanced technology beyond schools commonly distorts published reports of educational technology's lack of progress (65). Contrary to what many reports imply, the problem is not that instructional computers don't work well enough, or that they are not affordable, or that educators won't use them. The truth

is that computer-based and other high-tech instructional tools are being produced, sold, and used successfully and extensively outside of schools.

The key difference is that competition makes corporate and military trainers accountable for costs and results. And the principal reason for the almost total lack of investment in productivity-enhancing technological innovation, and the record of steadily declining productivity in formal education, is the inherent absence of competitive, market incentives in the bureaucratic structure of the U.S. educational system.

History argues that neither the abundance of current information technology nor further research and invention of even more exotic tools for teaching and learning will, by themselves, have much impact on the near-static pace of innovation in education. Pocket calculators have been ubiquitous for some two decades, yet their common use in pre-college education is still sedulously resisted. Television has been around for half a century yet its educational use remains largely trivial. The telephone is a century-old technology: yet hardly any school teachers in America have their own classroom or office telephones or even ready access to one.

An illuminating study by Douglas Ellson (1986) unveiled 125 instructional technologies and methods that, according to published research reports, have been proved capable of at least doubling the productivity of teaching. Yet Ellson observed that the use of these productive tools is virtually unknown in U.S. schools and colleges. As noted earlier, the cost to the U.S. economy of education's failure to adopt these kinds of proven, on-the-shelf teaching technology on a large scale may be as much as $100 billion a year.

Continual attempts to inject technological innovation into American schools and colleges through subsidized experimental, pilot, and demonstration projects or top-down bureaucratic mandates have failed as thoroughly as similar initiatives in the Soviet state agricultural system. In contrast, American agriculture has become the most productive in the world because adoption of technological innovation has been motivated by the competitive forces experienced by independent, market-driven enterprises.

The lesson in this is that the massive increase in educational R&D the country desperately needs will not pay off in actual, productive innovation in American schools without a solid dose of perestroika. That is, public schools will remain technologically backward until they are forced to compete to attract customers (students) who control the revenues the schools earn. And colleges will continue to eschew efficient instructional technology until instruction is unshackled from the priority of faculty research, productivity takes precedence over selectivity, and institutions are made to compete to generate real learning, not just elite credentials.

On the other hand, the agenda of educational restructuring that has recently evolved from growing disillusion with conventional "reforms" will bear little fruit unless a vastly expanded share of education's resources is committed to the research that is the wellspring of progress and productivity.

11. The Measurement Gap

In the winter of 1989, a new crop in a slew of national reports once again proclaimed that the math and science knowledge of American students falls at the bottom of the curve on international tests. But, writing in The Wall Street Journal, Mark Hartwig of Colorado College complained that "the problem is not with our children, not with the educational system, and not with the teachers. The problem is the tests that we use to measure our children's achievement." Curricula that nurture the "higher-order" reasoning skills called for in the latest round of reports in fact have been developed and used effectively in U.S. schools, Hartwig observes, only to be subsequently abandoned. Why? Because "the programs were given thumbs-down by [standardized] tests, which were measuring how many arcane facts the children had memorized," instead of the more sophisticated skills they had actually been taught. Because developing relevant tests is more costly and less profitable for commercial test firms, "our schools are being held accountable," Hartwig concluded, "to standards determined by what is convenient to the testing industry, not by what is best for our children and our country."

Beverly Hunter, president of Targeted Learning Corporation (TLC), a producer of computer-based courseware, recently developed an innovative instructional program for Macintosh computers called "Scientists at Work," a detailed simulation of biological research aimed at cultivating students' higher-order skills in acquiring and applying scientific data. Conditions of the government grant that funded the project required TLC to evaluate the program's effectiveness. But the only available testing instrument coming remotely close to the program's objectives showed no effect. "It's crazy to use paper and pencil tests to measure the multiple skills required to interact with a computer-automated, complex knowledge base," Hunter protests. But, she points out, developing an adequate computer-based test to measure the effects of this kind of instructional program is expensive, and could cost more than developing the program itself.

The federal Job Training Partnership Act program was designed to make continued funding of training programs contingent on measured success in placing trainees in private-sector jobs within a limited period of time. Some critics of JTPA have argued that this kind of program accounting promotes "cream-skimming": that is, program councils are encouraged to select for "training" the portion of the disadvantaged worker population that is most trainable and readily employable, and to screen out those who need basic education or other kinds of help even to become trainable.

These are but a few of the countless examples of how measurement processes affect every aspect of the normal operation of the nation's education and training systems. They also show how measurement problems commonly thwart attempts at innovation, reform, or restructuring. Here are some further illustrations:

-- Florida, Maryland, and other states raised graduation and promotion requirements, as determined by test scores, in the name of education reform. The immediate impact: more student failures and higher dropout rates.

-- Researchers such as Anthony Carnevale of the American Society for Training and Development have struggled for years simply to measure the amount of money U.S. employers spend annually on employee education and training. The key obstacles, Carnevale observes, are not only that business firms lack consistent procedures for accounting for such costs, but that many managers see an advantage in hiding such costs to protect their budgets from cuts during hard times. Former IBM training director Jack Bowsher (1989) reports that, when a thorough accounting was undertaken, his company found that it was actually spending about 50 per cent more on employee education than management had believed.

-- As a burgeoning number of baby-boom generation college faculty compete ever more intensely for a dwindling number of tenured positions in the United States, the dominant criterion for tenure award -- number of publications -- has led to increased publishing fraud, from the multiplication of spurious journals, to a proliferation of "co-authors", to simple plagiarism and outright faking of research.

-- Growing use of standardized testing and grading in kindergartens and even preschools has fed a "hurried child syndrome" of debilitating stress.

-- While publicly promoting continuing education as an inducement for military service, the U.S. Defense Department, as a matter of policy, does not recognize the General Equivalency Diploma -- based on achievement tests rather than school attendance -- to satisfy high-school graduation requirements for promotion.

-- A high court in New York State recently ruled that the Scholastic Aptitude Test could no longer be used as the sole criterion for awarding state scholarships, on the grounds that females, on average, receive lower SAT scores than males, and therefore are effectively denied an equal share of such grants. In a related story, a number of minority leaders have expressed outrage at the NCAA's Proposal 42, which would prohibit member colleges from granting athletic scholarships to freshmen with inadequate SAT scores, which generally are unfavorable to blacks and other minorities.

-- With rare exceptions, no evidence that the students of a U.S. school or college actually learn anything is required for the institution to be "accredited."

-- Despite widespread public clamor about America's "dropout crisis," the number of students actually dropping out of school each year in the United States is, for all practical purposes, unknown. Contrary to popular impression, the long-term trend has been downward: In 1940, 80 per cent of public school students dropped out before graduating high school; today the number is estimated at 25 per cent.

A Measurement Crisis

These anecdotes are only symptoms of a pervasive crisis of measurement in the American learning enterprise. Like other services, teaching and learning, education and training, are difficult to measure. Such measures that are used in practice are more convenient than valid. The result is a fog of uncertainty and confusion that obscures any discernable path to progress, and that increasingly suffocates the productivity of what is arguably the U.S. economy's largest and most strategically critical industry.

The American learning enterprise is a $500-billion-a-year economic sector -- unto itself, an economy larger than that of most nations -- hobbled by ignorance of its own purposes and performance.

The measurement crisis is a problem both of omission and commission. The physicist Lord Rutherford once said, "Only when you can measure a thing can you say you know something about it." Many efforts to manage or reform the nation's education and training systems founder for the lack of any measure of relevant causes or effects.

This is not to say that the need for measurement has been overlooked. To the contrary, education and training programs are riddled with accounts and measures of many kinds. Educational testing is a huge business in the United States. The director of testing in the Montgomery County (Md.) Public Schools estimates that 15 percent of students' time in that district is consumed by tests of one sort or another -- representing $90 million worth of school time annually. The proliferation of computers and of government regulations has unleashed a blizzard of statistics from monitoring, evaluation, accounting, and testing procedures.

Need for a Comprehensive Strategy

The blizzard has been kicked up by both administrators and managers focusing narrowly on specific measurement solutions to parochial problems. Many common measures are inaccurate, invalid, unreliable, or misapplied. The overhead costs of the clutter of measures and reports are rarely considered by those demanding regulation or accounting. As several of the anecdotes cited above demonstrate, the systemic impacts of specific measurement solutions often create new, even greater problems. Or, as one expert put it: "Be careful what you measure -- you are likely to get it."

While the prospects for technological innovation and structural reform of education systems are largely stymied by the lack of clear, germane measures of costs, effects, and benefits, the last thing that is needed is more micro-solutions to micro-problems.

Rather, what is urgently needed now is a comprehensive strategy to make measurement, in total, work efficiently and effectively. Cybernetic science teaches that understanding the creation and flow of information within a system is the key to controlling the system's behavior. More simply put: Knowledge

is power. Any attempt to rekindle American competitiveness by restructuring education and training systems must begin with -- or will end with -- the search for education's bottom line.

12. The Economic Development Policy Gap

Traditionally, economic development has been a policy concern mainly of state and local governments in the United States. The federal role was relatively small until the New Deal. Even since then, the great majority of federal development programs -- for example, in highway construction, water reclamation, electric power -- have been regionally or locally oriented, with effective control vested in state and local agencies. (The federal role is most dominant in those states where a large portion of the territory is federally owned.)

Many of the conflicts and paradoxes in economic development policy derive from, on one hand, the fact of state dominance in such policy and, on the other, the limits on state sovereignty established by the U.S. Constitution. Because states cannot control the migration of capital and people across their borders, much of their competition for economic development becomes irrelevant or counterproductive.

High-Tech Mania

Confusion over the relationship between "jobs" (that is, "jobs" as political issue as opposed to jobs as actual employment opportunities) and economic development in the unrestricted common market that is the United States often traps states and localities in a negative-sum, competitive game colloquially labelled "smokestack chasing." One example is a recurrent mania in development policy for anything "high-tech," making smokestack-chasing into "chip chasing."

Whatever the economic benefits of high-tech industry may be, employment is among the least. Available evidence (Carnevale and Goldstein, 1983) indicates that no more than 10 per cent of the U.S. workforce will be employed in high technology occupations and industry in the foreseeable future. High-tech industry in total will provide fewer than a million new jobs over the next decade.

Nor will high-tech offer a panacea to the highly paid, skilled workers, in such heavy industries as automobiles and steel, displaced by the combination of foreign competition and technological renovation. There will not be enough high-tech jobs to go around. The displaced workers will need to be thoroughly retrained to have any chance to get such jobs, and many of them, though skillful in their traditional work, lack the basic learning skills to be easily retrainable.

What is clear is that the major impact of so-called high technology on employment will not be in the production of the technology itself, but rather in the application of new technologies in many occupations across a wide range of industries -- manufacturing, agriculture, transportation, health care, financial services, arts and entertainment, and government.

Development and People

The recent mania over "high-tech" is symptomatic of a fundamental problem in U.S. development policy -- the discontinuity between the individual person and the collective community. The relationship between the development of individual human capital and the development of the communal economy is not as simple as is often claimed. Confusion about the relationship can be an obstacle to development of both kinds.

Since the economic disaster of the Great Depression, "jobs" has been a central obsession of American political rhetoric. Virtually every proposal in economic policy is justified in terms of its promise of "jobs." And, in political debate, that promise of collective "jobs" is presented as a symbol of the individual's hopes for economic security, independence, and advancement.

The reality is that macroeconomic development of a community (whether town, state, or nation) may be irrelevant to the economic prospects of some or even most of the members of that community. Such gross macroeconomic statistics as income, employment, and growth rates just do not say much about how any particular person is doing. On the other hand, the investments made in individual economic development -- particularly in education and training but even in housing or insurance -- are frequently out of tune with the broad trends leading toward a postindustrial society.

Conventional American political wisdom implies that development is a single line of "growth." Instead, a two-dimensional framework for development policy may be needed that addresses the economic development of the community and the economic development of the individual as separate but interdependent goals.

Perhaps only in this more discriminating policy framework would the learning enterprise be appreciated as both the essential instrument of individual advancement and the critical capital-forming industry of the postindustrial economy.

The one-dimensional rhetoric of U.S. political campaigns often seems to suggest that economic development is intended mainly to benefit working people; that those who pay the costs of development will receive the benefits; and that creating jobs is the same thing as creating work. These simplistic assumptions may be emotionally appealing, but they actually obstruct practical progress.

A more realistic, two-dimensional view of the development process would expose the following complications:

- The economic development efforts of state and local governments are focused more on property than on people.

- The constitutional guarantee of free trade and migration within the United States and the high mobility of the American population mean that the impacts of local development can be neither confined nor accounted for locally.

-- There is a substantial difference between creating jobs and creating work, comparable to the difference between distributing income and expanding income; furthermore, policies that contribute to one may be irrelevant and even contrary to the other.

Property and People

The traditional focus of economic development at the state and local levels in America is to increase the value of property located within the jurisdiction, particularly property that is immobile -- land, natural resources, buildings, factories, and transportation facilities, for example. The owners of such assets are the main beneficiaries -- and therefore are usually the most earnest advocates -- of "economic development."

Such property owners are interested in jobs only as one of several competing factors influencing the value of their property. Also, what is beneficial to the value of one piece of local property often is detrimental to another, so even when one property owner may benefit from more jobs another will not.

This observation is not meant to suggest that there is an absolute conflict between "jobs" and "economic development" in the United States. Many working people are also property owners -- commonly, of homes. And increased employment often may be necessary to developing the economic value of property.

But the correspondence, at the state and local levels, is not exactly one-to-one, and misunderstanding the relationship can lead to disappointment and frustration. For example, so-called "gentrification" may increase the average standard of living in a given urban area. But it commonly does so by replacing the resident poor with an immigrant middle class, not by raising the original inhabitants to a higher level.

Mobility and Locality

The second important complication to contend with in development policy is the remarkable mobility of people in America. In a nation that constitutionally prohibits barriers to migration or commerce among the states, people are free to "vote with their feet" and move to wherever they can get the best reward for their labor. This freedom of migration -- essential to making the United States the most prosperous common market in history -- complicates the relationship of employment and human capital to economic development at the state and local levels.

Because people are free to move around, there is no way to create jobs locally just for the local residents who need them. Though it is commonplace for politicians to promise "jobs" as a benefit of their policies, the reality is that state and local governments -- having no control over currency, migration, or trade -- are extremely limited in what they can do to affect the employment of their constituents. Attracting or cultivating industry in the name of "jobs" will not necessarily benefit current, unemployed residents who may not have the skills to get the jobs that will be created -- some or all of which may actually be taken by immigrants from somewhere else.

A particular state or local government's investment in training and education may enable local residents to compete more effectively for new jobs. But that investment in human capital development also will enable those residents tocompete for jobs located in another city or state. The only local benefit may be the reduction in unemployment insurance or welfare costs. But then, the very success of a local program that helped disadvantaged people to move up and out would be a magnet for disadvantaged immigrants from elsewhere.

By statistical measures, communities such as Boulder, Colorado or Austin, Texas that have employed growth controls to limit migration seem to have enjoyed considerable success in securing the benefits of economic development for their original residents. Omitted from the accounting, though, are the opportunity costs imposed on those who were prevented from immigrating or were forced to emigrate.

If people did not move around much, these paradoxes in local (and state) development policy caused by the freedom of migration might be dismissed as mere equivocation. But Americans actually are extraordinarily mobile. The 1980 census showed that, in most counties in the United States, roughly a sixth ("frostbelt") to a third ("sunbelt") of the local residents had moved from another part of the same state or from another state altogether within the previous five years.

With such a substantial proportion of "residents" continually coming and going, it becomes extremely difficult to trace who actually benefits and who actually pays when state and local governments attempt to create "jobs," whether directly or through traditional property-focused projects. And this omits the labyrinthine complications of the federal government's transfers of income from place to place and person to person.

While economic development of property is mainly a state and local interest in America, economic development of jobs -- in terms of productive workers and opportunities for meaningful employment -- is a national problem. This is not to say that employment is mainly a federal government concern, or even a government concern at all. Rather, it is simply to recognize that, within the United States, all citizens are free to compete in a single, national job market.

"Jobs" and Work

The third complication in thinking about development is that "jobs" and work are not the same thing. Work is what actually creates economic product. "Jobs" -- that is, employment -- is one of several mechanisms for distributing shares in the production process. Investment, debt, and taxation are other mechanisms for dividing up the stakes in production.

If the total amount of work in the economy were constant, the only way to expand employment would be through redistribution -- dividing the economic pie into more slices. Government has a number of effective devices for doing this -- from reducing the length of the workweek to taxing more private income in order to put more people on the public payroll.

There is a lot to be said for redistribution, but a basic problem with this option is that, at some point, it dilutes the incentives for work, investment, and overall economic growth. If the demand for employment is growing, simply slicing the economic pie into more pieces necessarily means taking income from some people to give it to others. The process tends to make the losers mad and to make the gainers complacent.

Increasing the total amount of work -- expanding the economic pie -- seems to be a more attractive way to increase employment without creating any absolute losers. If distribution is left constant, more work should mean more jobs, should it not?

Maybe. The problem is complicated by two things: technology and productivity. Work gets done by a combination of people and technology. Productivity is a measure of how much work people get done -- how much they produce -- in a given period of time on the job. As new technology increases productivity, more work can get done without requiring more people, and perhaps even requiring fewer people, to do it.

So getting more work done -- more economic product and a bigger pie -- may not directly increase employment or fulfill the political promise of "jobs." In fact, productivity growth in specific industries may even lead to reduced employment, as we have seen in automobiles, metals, and other manufacturing industries.

The hope is that the greater income generated by increased productivity will be respent, creating demand for new products and services in other industries, and thus lead indirectly to more employment. But when technological innovation and productivity increases are occurring simultaneously throughout all sectors of the economy, expanding total production may take place with little increase or even with a loss of jobs.

It was fashionable for U.S. politicians to agonize about America's flagging productivity during the past decade. But by letting its productivity slip, the U.S. economy was able to create employment for about 80 per cent of the tidal wave of new entrants to its workforce -- baby boomers, women, and minorities -- in the 1970s. During the same period, Western Europe outstripped the United States in productivity growth, but wound up with a net loss of three million jobs.

The growth of the fourth sector -- the knowledge sector of the economy -- offers at least partial deliverance from this quandary of postindustrial technology and employment. Because information is a virtually unlimited resource, the accelerating automation of information processing does not reduce the amount of human "knowledge work" to be done, but simply makes it more interesting.

It would take five to ten trillion human beings -- more than a thousand times the earth's total human population -- to do the work done by the world's current population of computers. Computers did not eliminate five trillion "jobs." Most of the work computers do simply would not be attempted if the computer did not exist.

Computers are eliminating some kinds of knowledge work -- such as drafting, medical diagnosis, navigation, and bookkeeping. But the net effect is only to change the quality of knowledge work (usually for the better), not to reduce the quantity of employment opportunities. The advance of "artificial intelligence" will only increase the needs and opportunities for work that depends on uniquely human creativity and intelligence.

Although American government can affect the distribution of employment and income, there is much less that government can do, in the short at least, to create work. Work is mostly created by private initiative and entrepreneurship. Nearly all of the 20 million new jobs added to the U.S. economy during the 1970s were created in small- to mid-sized companies.

Broad areas of government policy can, of course, affect the general condition of the economy, along with the prospects for work and employment. At the federal level, an imbalanced monetary policy can damage trade or plunge the economy into recession, reducing employment en masse. Lax immigration policies permit illegal immigrants to take jobs that, at least in principle, could be available to American citizens. Protectionist trade measures, most economists agree, wind up costing more in employment than they save.

By avoiding or undoing such counterproductive policies, government may provide a more congenial environment for economic growth, the creation of new work, and the possible expansion of employment. But removing barriers to enterprise -- though eminently desirable -- will not, by itself, deliver "jobs" any more than building a dam will necessarily bring rain.

There are some positive things government can do to help create new work. They are generally in the nature of long-term investments. Support for basic research and development (R&D) is one. Building and maintaining the public capital infrastructure is another.

A third is to strengthen the linkage between individual human capital development and the development of the macroeconomy. The need is not only for the right kinds of human capital to do the work that is wanted. Work is created by the imagination and initiative of individual people. People with the right kinds of human capital will create work and jobs for themselves and for others.

The need here is not for massive new entitlement programs or heroic industrial policies. The learning enterprise is the linchpin between individual development and macroeconomic development. Government can help cultivate the learning enterprise by:

-- removing the barriers presented by existing training, education, and other policies;

-- supporting basic research in such fields as cognitive science and molecular biology;

-- encouraging the development and transfer of heuristic technology;

-- developing and disseminating statistical information about the national learning system; and

-- facilitating communication between consumers and suppliers of learning products and services.

Neither "high-tech" nor economic development in general can solve the policy problem of "jobs." The employment opportunities American workers desire do not flow directly or uniformly from all kinds of economic investment.

As the baby-boom generation ages and the numbers of young people entering the workforce decline, there may even be a numerical surplus of several million jobs in the next few years. But many of the available jobs will be unattainable for adults who lack the right skill and knowledge. The low quality and poor prospects for advancement of many other jobs will make them unacceptable to many of the adults who want to work.

Neither the amount of available workers nor the amount of education or experience they possess offers assurance of meeting the human capital requirements of economic development in an age of structural transition. The quality of the worker -- in terms of function, fit, and flexibility -- is becoming most employers' major concern.

On the other hand, the overall quality of the work and the working environment will be the key determinant of worker frustration. To workers of the baby-boom generation, the "jobs" issue is not merely a matter of the number of openings, but is a constellation of needs -- challenge, independence, pay, location, mobility, status, and opportunity for growth.

In the absence of a technologically innovative and productive "learning enterprise," human capital inadequacies will be a brake on all forms of economic development in the emerging knowledge economy.

13. The Employer Policy Gap

The policies that have the most immediate impact on human capital are not those promulgated through government statutes and regulations, but are the policies employers establish to manage their organizations. In relation to America's human capital crisis, many employer policies are as deficient as government policies.

The Passing of Taylorism

The outworn philosophy of "scientific management" developed in the late 19th century by Frederick Winslow Taylor continues to dominate the management policies of American employers. Taylorism established a strict division between management and labor and reduced human capital to a fungible factor of production. Workers became the scientifically manipulated pawns in the industrial chess game played by management. In the Taylor scheme, the cardinal virtue of the worker was obedience, induced by the promise of growing wages and disciplined by the threat of unemployment.

The Taylor paradigm was well-intentioned and generally productive in an industrial age of mass production and standardization. But Taylorism has become obsolete in the postindustrial era, for several reasons.

First, the boundaries between worker, manager, and owner are increasingly blurred. Workers are becoming major owners of American business, either indirectly through what Peter Drucker has dubbed "pension-fund socialism" or directly through employee stock ownership plans (ESOPs). And foreign competition has induced a growing number of firms to embrace the principle of "participatory management."

Second, the massive entry of women into the U.S. workforce is transforming the nature of workers and work, and of managers and management.

Women-owned businesses are the fastest-growing segment of American small business. From 1972 to 1982, the number of self-employed women increased 69 per cent, compared to 13 per cent for men. By 1980, the 2.8 million women-owned sole proprietorships were increasing their number by 7 per cent a year, and had annual sales of over $40 billion (66).

The identity, needs, demands, and expectations of workers and managers are being radically changed by the growing impact of America's working women. Single or two-income parents need day care for their children. The member of a two-income household is less threatened by unemployment and less willing to transfer, but wants "flextime" and "cafeteria" benefits. Women owners and managers challenge the role models of both female and male employees. Recent U.S. court decisions concerning the "comparable worth" of female-dominated occupations threaten an upheaval in compensation policies. And so on.

Third, a study by Daniel Yankelovich and John Immerwahr (1983) concluded that the growth of "discretionary effort" in the American workplace is a major cause of torpid productivity and requires a fundamental shift in management philosophy. There is a growing gap between the high level of intensity and quality of work required to achieve "excellence," and the minimum level that suffices for the individual to avoid being fired or penalized.

Probing for the source of this "commitment gap," Yankelovich and Immerwahr found that three-quarters of American workers say that they could be significantly more effective on their jobs than they are now. The reason they are not more effective is that only 13 per cent of the workforce believes that working harder or better would benefit them personally. Three-fourths of all workers agree that management does not know how to motivate workers today.

And fourth, rapid technological change demands a workforce that is flexible, innovative, and entrepreneurial. In many businesses, product life cycles that once were measured in years or even decades have shrunk to months or even weeks. Rapidly changing products and services require employees -- both workers and managers -- who can exercise discretion and creativity, and quickly adapt their knowledge and skill.

As more workers rely on computers and other advanced technology in performing their work, the whole ethos of work and management will be forced to change. A study at Columbia University showed that "computer people" have

needs and motivations quite different from those of workers in traditional jobs: They are informal in dress, indifferent to "perks" and promotions, and comparatively unconcerned about money, but are motivated by the quality of the work itself and are insistent on the opportunity to continue to develop their technical expertise (67). For these people, work and learning are inseparable.

Learning for a New Paradigm

The rise of the learning enterprise is part of this broad paradigm shift in the management of American organizations.

In the age of Taylorism, training was mostly equivalent to programming the human worker for the robotlike performance of simplistic and repetitive tasks. In the course of the industrial age, American schools increasingly took on the characteristics of the factory, stressing specialization, analysis, measurement, and regimentation.

Now, in the postindustrial era, America has robots to do robotic work. They can be trained and retrained at the push of a button to perform those routine tasks that require no discretion, no judgment, no creativity. The United States no longer needs education and training institutions to "produce" standardized, reliable, predictable workers.

The most innovative and productive organizations in the U.S. economy treat their employees not as tools of production but as partners in a shared venture in which the complete development of the individual is recognized as a key factor of success.

Revising corporate cultures -- whether in business, government, or nonprofit organizations -- requires extensive new learning by managers and workers at all levels. The culture of collaboration, creativity, and individual initiative that many organizations are now pursuing "in search of excellence" can only be attained through a learning enterprise built on those same values.

14. The Education Policy Gap

At a time when the adult working population confronts a festering crisis of inability to function, poor fit of skills to work, insufficient flexibility to adapt to new conditions, and growing frustration in the face of change, U.S. public education policy is fundamentally misdirected. The flourishing debate about education has done little to defuse America's human capital crisis because, at least until recently, the framework of education policy has been predominantly fixated on youth instead of adults, on established institutions rather than innovative technologies, on pay rather than productivity, and on the interests of providers rather than the needs of consumers.

During the early 1980s, a slew of national commission reports and studies focused political attention on the poor performance of America's schools. A consistent theme of such reports as the U.S. Dept. of Education's A Nation at Risk (1983) was that the country's economic development depends on improving elementary and secondary education.

Though the welfare of America's children is an important concern, these reports had the unfortunate effect of muddling public perception of the critical relationship between learning and economic development. They often overlooked that:

-- the bulk of the baby-boom generation is already past school age -- over three-quarters of the people who will comprise the American workforce of the year 2000 are adults today;

-- a fifth of the existing adult workforce is functionally illiterate -- there are more adult illiterates in the United States than students in private and public secondary schools;

-- forecasters anticipate that technological and economic change will compel the average worker to change careers four times or more during a working lifetime -- "lifelong learners" is no longer a euphemism for dilettantes and hobbyists but an absolute necessity of economic competition.

What this means is that, if Americans could wave a magic wand and create perfect elementary and secondary schools tomorrow, the result (however desirable for the nation's children) would have no major impact on the U.S. workforce for the next two to three decades.

In short, public anxiety over "education" (children and schools) often obscures the adult learning crisis that is the major factor putting the U.S. economy "at risk" from the 1980s through the beginning of the next century.

As explained above, U.S. education's most serious policy gap is the studied indifference to productivity in educational institutions that is matched by a glacial rate of technological innovation. Besides its disdain for efficiency and the bias toward youth, current education policy also tends to be infatuated with the amount of education and neglects the quality of learning and its economic relevance.

Whatever may be the solution to America's looming human capital crisis, simply more education is not it. The facts indicate that if national education policy is concerned only with the amount of schooling, the United States may have too much of it:

-- the number of college-educated members of the workforce grew by 126 per cent since 1970;

-- over the past decade, graduate school enrollment increased by 22.4 per cent;

-- from 1973 to 1981, the number of institutions offering doctorates grew 36 per cent to 452, and the number offering masters degrees grew 22 per cent to 662.

The result of all this sprawl of higher education in America not only has been a decline in quality but also a rising tide of overeducated underemployed graduates:

-- nearly half of those who go to work after graduation will not get the kind of job traditionally held by college graduates;

-- in a study of more than 20,000 members of the high school class of 1972, 43 per cent of those with a college degree were not doing college-level work;

-- the number of college graduates seeking work grew three times faster than the total workforce since 1970;

-- in 1982, college graduates were twice as likely to be working in a blue-collar or service job as they were 12 years earlier (68).

In the United States of a generation ago, virtually any investment in more education offered an attractive rate of return -- the cost of education was more than paid back by the greater incomes commanded by college graduates and those with advanced degrees. But the return on investment in generic education has become increasingly dubious for all concerned.

In the 1970s, the difference in lifetime income between U.S. high school graduates and college graduates became so narrow that some economists estimated that the return on investment in formal higher education might even be negative (69). In the late 1980s, the gap between the incomes and employment rates of college and high school graduates has widened dramatically, making higher education now appear to be not only an attractive but perhaps essential investment.

These gross measures of the value of postsecondary education in the American economy can be misleading however. The growing division between the economic status of college and high school graduates has occurred not because the demand for more-educated workers has increased but because the employment opportunities traditionally available to individuals with no more than a high school education -- mainly in manufacturing or agriculture -- are rapidly vanishing.

The apparent demand for "more educated" workers actually is a kind of inflation phenomenon. While the basic skill requirements for entry-level work have been generally increased by technological and organizational change, the U.S. economy's demand for highly-schooled "professional" workers is largely oversupplied. Because jobs requesting no more than high school credentials are disappearing much faster than jobs asking for college degrees, it appears that the educational requirements of employment are increasing. But the numbers of jobs whose content genuinely requires college or postgraduate training are neither large enough nor growing rapidly enough to make up for the number of low-skilled jobs being structurally displaced.

As the U.S. economy faces, through the 1990s, a growing shortage of entry-level workers, and simultaneously a relative surplus of more-educated and more-experienced workers in many fields, the apparent economic benefit of further schooling beyond high school is likely once again to diminish.

In simple terms, what the emerging American economy really wants in its workforce is more learning and less education.

15. The Training Policy Gap

In 1983, before the divestiture of the Bell telephone system (70), AT&T signed a milestone contract with its major employee unions that committed the corporation to a $36 million program of training and retraining, open to all employees with more than one year of seniority. What made this agreement a watershed was that the training/retraining to be provided is not geared to any specific job but is general in nature. Thus workers whose jobs are threatened by technological innovation have the opportunity under this program to be trained for a new career, by their current employer. Since then, AT&T and the Communications Workers of America and the International Brotherhood of Electrical Workers have collaborated to further develop worker education and retraining services through a unique, jointly owned corporation, the Alliance for Employee Growth and Development, Inc. (71)

While progressive companies and labor organizations such as AT&T and the CWA and IBEW are creating innovative arrangements for meeting the human capital needs of a new economy, public policy on training and retraining is hobbled by outworn assumptions and misguided efforts.

American public policy addresses only a very narrow segment of the broad spectrum of training activity, ignoring many of the important needs for economic development. Existing vocational education focuses heavily on entry level training, and neglects the needs for retraining as well as the needs of advanced-level, skilled workers.

Existing public training programs serve less than 8 per cent of the population. Programs focus mainly on the young, the disadvantaged, and the hard-core unemployed, and provide some entry level training. But they give very little attention to retraining employed workers and upgrading their skills.

The total universe of U.S. training and continuing education is slanted heavily in favor of those who are already most well-off. Better-educated workers receive a disproportionately large share of all training. In 1981, workers with four or more years of college were 18 per cent of the labor force, but 35 per cent of the trainees. At the other extreme, workers with less than a full high school education were 23 per cent of the labor force but only 5 per cent of the trainees (72).

So, private training resources are skewed toward the top of the job pyramid, while publicly funded job programs concentrate on the very bottom, leaving the mass of workers in the middle -- the ones whose jobs are most threatened by technological and economic changes -- with the least support for training or retraining.

Another distortion: Small companies are America's major training ground for new workers, in effect subsidizing the training costs of big corporations as smaller businesses lose experienced workers to the higher pay larger firms can afford. Companies with fewer than 100 employees account for 58 per cent of total employment, but they hire 67 per cent of first-time workers. Yet most federal training grants go to big, not small, companies (73).

A further, chronic problem is that many vocational education and training programs -- particularly those provided by the public sector -- give training in skills and vocations that are already out-of-date. In the worst cases, such programs persisted in training welders and lathe operators long after robots and computers had made those jobs obsolete. High-tech companies find that even graduates of top-grade engineering schools often require substantial additional in-house training to catch up with the latest technology.

The focal point of federal policy on training/retraining today is the federal Job Training Partnership Act (JTPA), created in 1983 to replace the ill-fated CETA program. CETA's critics charged that the program degenerated into an income-maintenance program for the unemployed, provided "training" of little economic value, and got real jobs for only a few percent of its participants.

Critics of JTPA in turn charge that, by tying funding to successful job placement of trainees, the program is designed to enlist the best prospects -- those most likely to be employed anyway -- and leave the worst cases on the street. But the basic problem with JTPA and similar programs to train or retrain the unemployed is that most disadvantaged workers are less in need of job-specific training than of help with basic skills prerequisite to being trainable and employable. For instance, one-third of dislocated workers lack a high school diploma, and another third have diplomas but are still functionally illiterate.

16. The Confused Social Contract

Underlying the array of American policy gaps described above is a fundamental confusion about the appropriate distribution of costs, benefits, and responsibilities for adult learning.

America's social commitment to the education of children is almost universally accepted, and, despite occasional arguments about the adequacy of the nation's efforts, the responsibilities of parents, teachers, taxpayers, and churches to support childhood learning are broadly recognized. But the United States lacks a comparable "social contract" to meet the learning needs of adults.

U.S. employers invest tens of billions of dollars in training employees. But a quarter or more of this expenditure may result simply from the deficiencies in workers' basic skills that employers often feel are the responsibility of public education.

Employers also are often irked to see a worker they have invested in training then leave to work for someone else. For example, the $30,000-a-year cost of the Wharton Executive MBA program is paid in most cases by the student's employer; yet over 40 per cent of the graduates take a job with another employer within two years of graduating (74).

American workers invest billions of dollars worth of their own money and time in postsecondary education and training of various kinds. But if the

expected economic benefits fail to materialize, workers often blame government and/or industry for not providing accurate career guidance or adequate financial aid and job placement assistance.

Saying that government has some responsibility in this area leaves unresolved the key questions of what specific services government is supposed to perform, for whom, and who is supposed to pay the cost.

Most of America's public and private policies concerning human capital have a protectionist character that may reflect the country's essential ambivalence about the ownership of human capital. Traditionally, the relevant policies have been aimed more at protecting the holders of existing jobs from the threat of change than at facilitating work transitions. Uncertain of their ability to control and profit from the intrinsic knowledge, skill, and experience that constitute each individual's human capital, Americans in the past have sought the illusory security of tenure in an extrinsic "job." They mortgaged themselves to their titles.

Slavery, indentured servitude, and some traditional laws that treated women as virtual chattels settled many questions of human capital ownership with brutal clarity. The liberal laws that succeeded these unjust institutions are more humane, but nevertheless are complex and vague in their treatment of human capital ownership; for example:

-- Electronic Data Systems Corp. is suing to recover $9,000 in training costs from a former employee who signed a "promisory note" pledging to repay such costs if he left voluntarily or was fired within 24 months of starting a special program. "I didn't learn anything I didn't know," claimed the employee, who quit the company after 18 months, calling the EDS arrangement "indentured servitude." (75)

-- In the divorce case of Sullivan vs. Sullivan in the state of California, a woman who had supported her ex-husband through medical school demanded a share of all the expected future income he would earn as a doctor -- thus claiming that his medical degree was part of "community property."

-- Some government financial aid programs for medical and dental students require several years of postgraduate service as reimbursement; such a lien on human capital is difficult to collect. For example, the National Health Service Corps provides scholarships to educate health professionals in return for an obligation to serve at least two years in areas (usually rural) lacking primary medical services. But over half of the scholarship recipients never fulfill the service obligation -- 30 per cent pay the government back for their training while another 23 per cent simply default, returning neither money nor service for their free education (76).

-- In the knowledge sector of the economy, the boundary between human capital and intellectual property is a twilight zone that is increasingly a combat zone. A prominent physicist at the California Institute of Technology resigned when the Institute claimed ownership of a valuable computer program he had developed on his own time. When three IBM engineers who had helped develop the PC left the

company to produce competing products they were charged with stealing trade secrets, that is, the proprietary knowledge they had gained in the course of their work.

Human capital starts with a basic genetic endowment and is then increased by the product of knowledge, skill, and experience. But who owns it? More particularly, what equity interest is conferred by the investment in human capital? What are the proper measures of the return on that investment? What is the appropriate distribution of the profit or loss from human capital investments? The growth of the U.S. learning enterprise and its value to the economy will be hampered until America has better and more universally acknowledged answers to such questions.

CHAPTER 4

TOWARD THE 21ST CENTURY

This report describes a revolution in the technology and social organization of learning that is irreversibly underway in the United States. But the course of this heuristic revolution and the value of its outcome are not predestined, and are subject to a wide range of possibilities. How beneficial the revolution will be and who will benefit from it in the imminent new century depend greatly on choices and commitments being made today by America's leaders and people.

17. Educational "Perestroika": The Emerging U.S. Movement

The gaps between the performance of America's traditional education and training system and the radically different structural needs and technological opportunities of the 21st century economy have not been ignored. In fact, just as Eastern European nations are abandoning state-controlled economies for competitive markets under the banner of perestroika, as the countries of Western Europe are restructuring their economic relationships to create a vast new common market after 1992, and as major industries -- financial services, aviation, telecommunications, computers -- are engaged in corporate restructuring to meet the challenge of new technologies and market conditions, a new movement to restructure the nation's learning enterprise is now gathering force in the United States.

As in these other cases of restructuring, the central thrust of this movement is away from centralized, bureaucratically administered systems and toward open, competitive, entrepreneurial market arrangements.

In the first half of the 1980s, emerging dissatisfaction with the performance of American education was expressed once again in marginal efforts to adjust established institutions in the name of "reform." In the latter half of the decade, though, the mood of political and business leaders and of the American public in general has become more frankly radical as patience has worn out with the rising cost and paltry impact of conventional reforms.

By 1986, a new wave of national task force reports began to reveal this shift. The report of the federal Dept. of Education's National Task Force on Educational Technology surprisingly called not merely for more classroom computers, but for a concerted effort over the next decade to use technology to transform education from the traditional time-in-grade system to a system base don individualized, self-paced instruction. At the same time, the Carnegie Corporation's influential task force on the teaching profession issued a report demanding a "fundamental redesign" of the entire established system of public education. "We're not talking about incremental improvements in teachers, in teaching, or in schools," Marc Tucker, director of the Carnegie project proclaimed; "We're really talking about radical improvements."

In the same year, a group of task forces of the National Governors' Association proposed a startling list of bold measures to reconstruct U.S. education, including:

-- State deregulation of local school systems in exchange for district accountability for better results;

-- far-reaching revision of teacher training, recruitment, compensation, promotion, performance, and other employment policies;

-- parental choice, and competition among public schools;

-- "report cards" for schools -- measures of system performance;

-- state takeover of educationally "bankrupt" districts or schools; and

-- pervasive overhaul of instructional technology.

The impatience with reform and the imperative for more fundamental, systemic change was unmistakable. "Despite the national attempts to reform education," explained then-Governor Richard Lamm of Colorado, "we are worried that the nation is creating solutions to the wrong problems. We are afraid that states are working for more of the same without taking a good hard look at the system itself."

In the subsequent four years, the movement to restructure American education has accelerated. In the fall of 1988, FORTUNE magazine reported that a group of 100 U.S. corporate and political leaders its editors convened for an "education summit" unanimously agreed that what the nation needs is nothing less than "a complete restructuring of the school system -- a perestroika of education." (77) The following summer, The Wall Street Journal reported that "business has become one of the radical elements in school reform. Some corporations, instead of supporting the old system, want to scuttle it and start over." (78)

The restructuring of U.S. education and training is not just rhetorical but starting to happen in practice. The state of Minnesota enacted a law that by 1991 will give K-12 students the freedom to choose to attend any public school in any district. Similar legislation to open public schools to choice and competition is pending in 28 other states and has passed in several. When the Boston Compact -- an agreement between the local business community and the city school district to guarantee jobs to public high school graduates in exchange for better test scores and less dropouts -- collapsed after the school system failed to deliver promised reforms, the business leaders fomented a political drive that resulted in a new policy of school-based management and family choice of schools.

The city of Chicago recently turned over responsibility for managing each of its public schools to local committees controlled by parents. The superintendent of the San Diego school district has collaborated with the head of the teachers' union to formulate a long-range plan to "restructure" the public school system that permits any regulation or contract provision that gets in the way of innovation to be waived. The new National Board of Professional Teaching Standards has proposed competency-based evaluations that

would replace traditional university credentials as employment criteria for teachers. Adoption of such a certification system would lead to greater mobility and competitiveness in formal education's professional workforce.

Recent and pending court decisions promise even more radical change. State courts in Kentucky and Texas have ruled that the existing public school systems, based on funding by local property taxes, are unconstitutional, (79) and have ordered the respective state legislatures to completely redesign their education systems to achieve effective equality of opportunity.

The winds of restructuring also are blowing through post-secondary and "further" education and training. The state of Michigan has created what it calls the "Opportunity Card" -- a kind of credit card that merges the host of government adult education and job training programs into a single account, thereby encouraging consumer "shopping" and competition among service providers. The Committee on Economic Development, a business association, issued a report (1985) that found that secondary vocational education was economically useless; the report called for the abolition of high school voc.ed. in favor of increased emphasis on essential thinking, communication, and computation skills. This and other business pressure has unleashed a fundamental reappraisal and redirection of vocational education to emphasize strong basic skills and workforce readiness rather than narrow technical training.

Even colleges and universities are learning to compete in new ways. Satellite campuses are making major universities increasingly into national rather than local enterprises. For instance, Boston's Northeastern University is a major supplier of engineering and management education to professional employees in California's "silicon valley." The University of Southern California, Florida's Nova University, and New York Institute of Technology are among a number of colleges and graduate schools offering on-site degree and continuing education programs at satellite facilities in the Washington, DC area. At the leading edge, the National Technological University is an accredited institution with no campus or faculty of its own that delivers televised engineering courses and degree programs by communications satellite to thousands of students at corporate worksites all over the United States.

Upward-spiraling costs have prompted a gathering challenge to the root economics of U.S. higher education. Between the 1980 and 1988 academic years, disposable personal income per capita in the United States grew 68.8 per cent; at the same time the cost of attending college increased 118.1 per cent at private universities and 82.2 per cent at public universities (80).

Concerned about such fast-rising college prices, a panel of higher education leaders headed by Robert Zemsky of the University of Pennsylvania recently issued a report calling for fundamental changes in institutions' budgeting practices to focus on increasing productivity and containing costs (81).

The courts, again, may unleash even more radical movement toward competitiveness in higher education. The U.S. Justice Department this year initiated a formal investigation of the enrollment and financial aid practices of several dozen major universities for possible violations of federal anti-trust laws (82).

The NTU Satellite Network

NTU Participating Universities

Arizona State University
Boston University
Colorado State University
Georgia Institute of Technology
GMI Engr. & Mgt. Inst.*
Illinois Institute of Technology
Iowa State University
Michigan Technological University
North Carolina State University
Northeastern University
Oklahoma State University
Purdue University
Rensselaer Polytechnic Institute
Southern Methodist University
University of Alaska
University of Arizona
University of Florida
University of Idaho
University of Illinois - Urbana-Champaign*
University of Kentucky
University of Maryland
University of Massachusetts
University of Minnesota
University of Missouri-Rolla
University of Notre Dame*
University of South Carolina
University of Southern California*
University of Washington
University of Wisconsin-Madison

* Contribute solely to the Advanced Technology and Management Programs

The educational restructuring movement in the United States is still in its infancy. That it is alive and growing is clear; where it will lead remains to be seen. But the effectiveness of America's educational perestroika will do much to determine the form and productivity of the U.S. learning enterprise -- and by extension, the entire U.S. economy -- by the turn of the century.

18. Alternative Future: An American Scenario

This section traces a scenario of the American system of education, training, and learning of the next decade. The purpose of the scenario presented here is to provide a graphic vision of how near-term policy choices may affect what the American learning system will be like at the end of this century. In particular, the scenario is intended to show the impact of policies aimed at a fundamental "restructuring" of education and training systems. It also serves to demonstrate the intimate, dynamic connections between continuing education or retraining and the rest of the fabric of the American learning enterprise.

The scenario gives a broad view of the whole American education, training, and learning system in 1999, not just a single institution or segment. The anticipated result of restructuring is a U.S. education, training, and learning system in the next decade that is notably different from what currently exists.

The general message of the scenario is that restructuring leads to a learning system that not only serves the human resource needs of the United States better, but that also offers richer opportunities for enterprises hoping to market, profitably, advanced technologies and systems for education, training, and learning. But also, the Restructured System scenario requires some basic, near-term changes in both public policies and corporate strategies if it is to become a probable future rather than just a potential one.

1999 Restructured System Scenario

The entire system of education, training, and learning in the United States, especially public education, has undergone a fundamental change to a new "heuristic" philosophy of learning and development. In practice, this transformation is rooted in a few basic changes in the design and operation of the educational process. What Benjamin Bloom called "mastery" learning, based on criterion-referenced programming and assessment, is the standard instructional practice at all levels of education and training. The age of the "Carnegie unit" that purported to measure educational progress by time-in-class and time-in-grade has passed. Normative grading ("on the curve") is disappearing, and in some communities and states has been actually banned. The switch to mastery learning has been facilitated by the extensive reliance on telematic technology to design, manage, and deliver customized instruction to each individual learner.

This technological paradigm shift in learning was made possible by two basic reforms in public policy. First was the "deregulation" of education, beginning in the late 80s, which cut back the role of government to its essential functions -- defining and certifying the basic outcomes that

education is supposed to achieve, and protecting consumers -- and opened up the system to consumer choice and thereby to competition among providers of services and products.

The second key reform was the "decredentialization" movement of the early 1990s, where initially several states and finally the federal government simply prohibited the requirement of academic diplomas or degrees as a condition of employment. The effect of decredentialization was to end the "paper chase" that was estimated to be costing the U.S. economy $100 billion or more annually. It quickly created a wide-open market for "mastery" that the technology of mastery learning was ideally suited to serve. Instead of chasing degrees, employers and workers alike were able to concentrate their investments in learning (or "human capital development") on attaining, though the most cost-effective means, the functional skills and knowledge required for productive performance in a job or career.

As a result of these key changes of policy and operation, learning in 1999 has become the nation's #1 growth industry, a strategically critical economic sector, and the major factor in restoring American competitiveness in the global marketplace. This new industry has had a transforming impact on almost every aspect of education, training, and learning in the U.S.

Education for Children. To begin, consider the sweeping changes in the education of children. Most states have completely reversed the tendency, which reached its watershed in the late 1980s, to "micromanage" the education process, regulating schools, teachers, the curriculum, and nearly every minute of classroom practice. Most state education regulations have been dropped, except for those essential to children's health and safety. Instead, the states have concentrated on defining specific objectives and measures of educational performance that are important to the public interest in education. These are expressed in terms of the requirements of basic education, and of the measurement and certification of mastery.

In most states, the "basics" are defined in terms similar to those anticipated by George Leonard a decade earlier: cognitive, affective, physical, and social. The requirements in most of these areas are defined by achievement of objective, measured outcomes: knowledge, skills, indicators of physical fitness. But some of the more qualitative, intangible goals of basic education are defined by experiential standards. For instance, the goal of racial and ethnic tolerance is no longer pursued in most places by the instrument of forced busing. Instead, many states include pupils' completion of a minimum of 30-40 months of experience in an approved program of "cross-cultural communication" as one of the requirements of the "Certificate of Capability" (CC) that increasingly is replacing the old "high school diploma." In short, the state governments have focused their policies on the what of education and have largely given up dictating the how.

The most impressive feature of the new education system may be the great diversity of settings, methods, technologies, and styles it includes, and the wide variety of choices it offers to families. In contrast to the utopian visions of the past, there is no one "school of the future." Actually, the settings for children's education range from "at-home" to neighborhood (the rebirth of the "one-room school"), magnet (with specialized curricula), the "traditional academy," and a growing number of settings provided by both major

employers and local public education agencies that bring day care and education of employees' children to the workplace -- to increase the opportunity for working parents to maintain contact with their children and be involved in their children's education.

What is increasingly common across these diverse settings is utilization of advanced learning technologies to deliver personalized instruction. Whereas a decade ago only the handicapped and most gifted students received the benefit of an Individualized Education Plan, today the IEP is standard for the great majority of students. Even in schools that retain the form of the class-grade-teacher system, the focus of most state requirements on mastery and criterion-referenced achievement has led to extensive incorporation of individualized instruction under the institution's "traditional" surface.

The vastly greater productivity of advanced learning technologies, and year-round schools in most places, mean that most students complete their "basic" education and receive their "CC" by around age 15. Most then go on to community college, cooperative education, intern/apprenticeship, or work-study programs. Some enter the workforce while some of the most academically oriented begin college. "Drop-outs" have been largely eliminated, since there are few "high schools" left to drop out of.

The traditional school building is steadily being replaced by a more cost-effective "high-flex" architecture that integrates modular, multi-function "school" settings with residential, commercial, and other settings. The advantages are several: "schools" can be quickly expanded, contracted, moved, or spread among several locations to meet variations in enrollment demands; a child's education can be more intimately commingled with other economic and social activities in the "real world"; working parents can get closer access to and involvement with their children; local education agencies can create "profit centers," can contract for maintenance and operation services and/or can share those costs with other tenants, and generally can get a far more favorable return on their real estate investments.

Besides the reorientation of curricula to mastery and the widespread implementation of telematic instructional delivery systems, perhaps the most notable technological change in education is the extensive application of expert systems to every aspect of the process: diagnosis, testing, instructional management, administration, staff training, counseling, and instructional design, as well as to instruction itself.

Organizationally, local education agencies are less "school" districts and more generically "education" districts. They increasingly serve not only children but the entire family and people of all ages. Generally, districts are less involved (in some cases not at all involved) in the direct operation of schools. Rather, district agencies purchase services from contractors (including professional "teacher" group practices), test, evaluate, provide financing for family education services, and offer consumer guidance and protection.

Education & Training for Everyone. The explosive growth of the "fourth sector" or "knowledge sector" of the economy has entailed a new, extensive synthesis of work and learning. Only 5 per cent of U.S. workers actually make a product on the job; the great majority of the workforce is employed in

providing services or managing automated systems that produce goods and services. As a result, learning is no longer viewed merely as preparation for work, but as an inherent part of most American jobs. In particular, the proliferation of "embedded training" in most operating systems, from aircraft to power plants to factories, has dissolved the barrier between performance and training. Similarly, expert systems have been incorporated so widely in the production of goods and services that most workers are involved to some extent, knowingly or not, in the continual maintenance and upgrading of such systems.

The fallacy of the dehumanized vision of the automated economy depicted four decades ago by Kurt Vonnegut in his novel Player Piano was that it failed to recognize that expert systems are not static. Such automated systems are extremely good at codifying and applying expertise, but not much good at creating it. Rather, they need human adjuncts to constantly evaluate and improve their expert knowledge.

So the relationship between learning technology and human has become highly symbiotic. Telematic and other technologies are widely used to facilitate almost continuous human learning on the job and at home. But more and more human workers are engaged, consciously or not, in "teaching" intelligent automated systems: what one scientist heroically called the "immanent brains of a new species of terrestrial intelligence."

The prohibition of academic credentials in hiring has meant that mastery learning is directly linked to "mastery employment." One result is the growing practice of "skill-based" hiring and compensation. The increased emphasis on the entrepreneurial or intrapreneurial capacity of each worker, the steady decline in institutional or corporate loyalty, and the focus on personal management of "human capital development," have inspired some to call this the "age of the free agent." The flatter, "horizontal" environments of most schools and other education and training settings mimic the flatter structures of most of the organizations in which Americans work.

Mastery learning and mastery employment have required explosive growth of the technically sophisticated business of testing and certifying competencies. A field once dominated by Education Testing Service now enjoys robust competition.

To meet the needs of the growing numbers of "free agent" workers, a legion of Human Capital Investment Planners -- following the model of financial planners, realtors, accountants, and brokers -- has sprung up. These agents use expert system models to analyze individual learning and development needs required to meet personal goals, and recommend and help locate appropriate, cost-effective services and products to meet those needs. Though the rapid growth of this business has attracted many freelancers, the business is increasingly dominated my large national chains and franchises.

Two new financial instruments -- the Individual Training Account and Home Equity Value Insurance -- now help assure adequate family funds for continual reeducation and retraining. The ITA, modelled after the Individual Retirement Account, is a fund that accumulates contributions by both workers and employers to help finance "retooling" of workers' skills and knowledge. HEVI was created to protect workers' chief form of saving from collapse when the local economy of an area dependent on a major employer or industry is

depressed by plant shutdowns or downturns in that industry. HEVI works to assure that workers in such areas can use their accumulated equity to finance retraining, relocation, or new business starts.

One of the most dramatic facets of the rise of the "knowledge sector" to economic prominence is the growth of "popular" science and other research. Where once only a few thousand highly trained technical specialists were engaged in research and scholarship, the numbers of people now performing such work is approaching millions. Just as it would have been difficult in the 19th Century to imagine a society where the great majority of workers would not be farmers and factory workers, but would do "white collar" and "service" work in offices, it was difficult for both the academic community and the general public to imagine an economy where a large share of the labor force is engaged in what once would have been "scholarly" work.

In parallel with the broadened participation in research and scholarship, there has been sharply declining interest in "academic" tracks and "degrees," even within education institutions themselves. After legal decredentialization, higher education enrollments quickly declined by over 50 per cent as the majority of prospective students discovered that mastery learning and mastery employment offered far more fruitful and economical avenues to fulfillment of career goals.

Though immigration and the epidemic of teenage pregnancy and illegitimacy of the late 1980s inevitably swelled the ranks of the "underclass," the sense of hopelessness among the disadvantaged has been clearly reduced by the great improvement in learning and work opportunities. At the end of the 1980s, welfare systems were transformed to focus on work and employment even of the hard-core group of single mothers with young children. At the same time, unemployment systems were revamped to encourage retraining and entrepreneurship instead of mere income maintenance. The net result is that the idleness of unemployment has been virtually eliminated: Those who are not currently in a job or business are being paid through one of these systems to be actively engaged in building their human capital by learning.

Learning has become much more a family-based and much less a school-based social function, as well as a more trans- and inter-generational process. Recognizing that parents are the principal educators of children, local education agencies provide much more formal training and support for parenting today than in the past. Household purchases of educational products and services, for all members of the family but especially for children, have increased steadily in the last ten years. This growth has been facilitated by the expansion and diffusion of home information/learning technology: Digitally integrated computer, broadband telecommunication, information storage, and robotic systems are present in a majority of U.S. homes, though there is not yet what could be considered a "standard" system.

Technical Systems. By 1999, a number of key technologies have contributed to the transformation of learning systems:

-- the desktop supercomputer and cheap mass storage;

-- broadband (fiber optic) telecommunications;

-- application of artificial intelligence to interfaces (voice, eye movement, brain wave, etc.);

-- expert systems; and

-- BET -- Brain Enhancement Technology -- from applied brain and cognitive science.

Among the most dramatic impacts of these technological advances have been in the growth of "embedded" and "symbiotic" learning which have obliterated the distinction of work and learning, and in the ubiquitous access to "distance" learning which has made the location of education or training institutions almost insignificant to the learner.

In contrast, some of the longstanding core technologies of traditional education are now vanishing species: the textbook, the classroom, the lecture and recitation, the diploma, the teacher/professor.

Among the most far-reaching consequences of the evolution of learning technology is the growing split, almost a paradigm shift, in the universe of information technology between learning systems and data systems. The mindset of the leading producers of the highly interactive, symbiotic learning technology that is progressively superseding data processing in management and operations seems to be quite different from that of most of the old leaders of the computer and data processing industry. Just as the old vacuum tube makers were generally unable to make the shift to the new world of silicon transistors and chips, many giants of the number-crunching business appear to be fading in the wake of younger firms more attuned to a new concept of information technology.

Settings and Practitioners. Learning at all ages in 1999 is delivered primarily by systems not teachers. In particular, the explosion of automated expert systems has ended any need for a would-be expert professor to stand in a room and teach "facts." Lectures are appreciated for their entertainment and inspirational value, not as an important medium for delivering knowledge.

Providers of basic educaticn (K-12 and elementary/secondary are largely obsolete concepts) operate in a diversity of settings: employee-owned schools, professional practices, franchises (e.g., Sylvan, Huntington), modular systems (e.g., Tandy, JHM), and courseware products and systems delivered through a variety of packaged and on-line media. "Teachers" working in "schools" are a dwindling minority of the corps of learning professionals and paraprofessionals (in the post-credentialism age, the term "professional" no longer offers much as a cachet). As Cetron anticipated over a decade ago, there is now a considerable variety of specialized jobs in the learning business, including: learning diagnostician, software knowledge compiler, courseware composer, curriculum designer, mental-health diagnostician, performance contract monitor, social skill evaluator, cross-cultural communication manager, small-group learning manager, large-group learning manager, instructional media producer, and home-based instruction consultant.

The noteworthy changes in the institutional structure of education in the 1990s are the progressive disappearance of high schools, the shrinking number of so-called "liberal arts" colleges and universities, and the explosive

growth of community colleges and similar institutions. The expansion of the community colleges was sparked by the success of the "Minnesota Plan" of the 1980s, which allowed public school students to enter higher education institutions after what was then still considered "10th grade" and to take their state education aid with them. As part of the general deregulation movement after 1989, the model quickly spread to other states, and contributed to the disappearance of the high school, an institution that had been condemned as a dreary waste of time by many of the major education reformers of the early 80s, such as Boyer or Goodlad. The wide range of services, delivery systems, populations served, and general flexibility and innovativeness already established in the community colleges positioned them to meet the new demands unleashed by the learning revolution. Today, in 1999, most students, after completing their CC at around age 15, continue their learning through some combination of community college programs and employment (whether paid or volunteer).

Not only has the number of academic colleges and universities declined, but, among the survivors, there is less focus on degree-granting. Many have diversified into other functions and services: corporate training, executive conference centers, special research centers, boarding schools, or reorganization as community colleges. There is greater functional division between research and teaching than in the past, as advanced instructional systems offer far more cost-effective and flexible learning services than professors in lecture halls.

The surplus of baby-boom generation academics with strong research interests and credentials, combined with the shrivelled demand for teaching faculty, led to creation of a growing number of pure research institutions, modelled after Germany's Max Planck Institutes. By freeing talented researchers from the distraction of the increasingly artificial and obsolete "teaching burden," these institutions have made an important contribution to restoring U.S. productivity growth and leadership in research and technology.

The diversity of institutional forms and roles also has blurred the earlier distinctions between public and private, or between corporate and collegiate. There are fewer full-time, exclusive "faculty" jobs and more adjunct and shared faculty relationships. Many technical specialists perform research, production, and instructional functions either simultaneously or alternatively in a variety of settings. Many major corporations and other employers provide more cost-effective training and education of technical specialists -- scientists, engineers, managers, and other "professionals" -- through the combination of on-the-job experience and distance learning than traditional universities can match. Distance learning has become so central to higher education that major institutions (e.g., Northeastern University, New York Institute of Technology, National Technological University) are no longer bound to a central campus; rather they compete across the country, and increasingly, around the world.

In general, compared to a decade ago, there is more differentiation of "educator" jobs, and the education professions, like other vocations, are increasingly populated with "free agents." And, for both practitioners and settings, there is far more commingling and even integration across the erstwhile boundaries of "elementary," "secondary," "higher education," and "training."

Learning Has Become a Strategic Industry. The bottom line of the transformation of education and training systems is that learning has become the premier growth industry of the U.S. economy. Major (e.g., Fortune 200) companies now specialize in learning technology, products, and services. Learning science and technology now accounts for a proportional or larger share of R&D investment compared to other industry sectors. The new learning industry has become a critical factor of U.S. international competitive advantage, and is even now making a substantial and growing contribution to national export revenue.

Critical Choices

The scenario demonstrates that the United States faces some fundamental, critical choices about education, training, and learning that are likely to have an important impact on the health of the American economy and society a decade hence. The essential challenge is to make the possible, desirable Restructured System scenario into the probable scenario. The overall message of the scenario is that this will require a general shift of strategy from "more of the same" to "restructuring."

19. Recommendations

I conclude with several recommendations for further work to develop national policies responsive to the revolutionary changes in teaching and learning taking place in the modern economy. These recommendations are aimed both at OECD in general, and in particular at the U.S. Government as it contemplates efforts to follow the Workforce 2000 project under which this report was produced.

New Thinking

As the Soviet Union's President Gorbachev continually emphasizes, perestroika, or "restructuring" of basic social institutions demands "new thinking." This requirement applies no less to the reinvention of the largely planned economy of education in the United States (and elsewhere) than to the reorganization of the planned economies of whole nations in the East.

The new thinking about education, training, and other human resource policies begins with a recognition that the emerging wave of what I have called "heuristic" technology is irrevocably transforming the role of learning in the modern economy. In the new era, the enterprise of learning has acquired the strategic importance to national vitality that such basic industries as steelmaking held in the fading industrial age. Because technology increasingly is divorcing learning from instruction, and embedding it ever more in the fiber of production and social activity, the "learning enterprise" is an economic entity whose mass far exceeds the bounds of what is conventionally recognized as education or training. In this new paradigm, effective policy thinking may be undermined by analysis that persists in dividing a seamless learning enterprise into traditional categories such as elementary versus secondary versus higher; or vocational versus academic; or

basic versus advanced; or entry versus continuing; or even education versus training.

In the United States, and perhaps in other nations as well, there is an acute need to correct some deeply entrenched biases in popular thinking about learning and human capital development.

First, there is the extreme bias toward youth. Despite common lip-service to the merit of "lifelong learning" or "continuing education," in the United States the overwhelming preponderance of political attention, and hence public investment, is focused on children and adolescents. Instead, a genuine acceptance of learning as a lifespan activity, and a proportional reallocation of attention and resources to all phases of that activity, are urgently needed.

The new thinking demands, second, a shift of focus from the performance and demands of academic institutions to the processes of teaching and learning, and in particular to how technology mediates those processes.

Related to the latter, the bias toward teaching as a kind of social manufacturing that "produces" graduates, technicians, managers, or citizens needs to be replaced with a vision of learning as an autonomous, coevolving productive process in which humans collaborate, both with each other and increasingly with non-human elements.

Americans' obsession with education as a sorting process, in which failure is a necessary antecedent to "excellence" as measured by distribution of test scores, needs to be replaced with comparably eager attention to personal competency in knowledge and skills.

And, in assessing the value of education investments, the established bias of America's attention to the volume of expenditures, students, teachers, courses, hours, and so forth should be corrected by a primary focus on the productivity of such investments, in terms of the specific outcomes achieved in relation to cost.

Research

The OECD request for this study concluded with a series of questions about the markets for education and training. The assessment of markets is precisely what the new thinking about the learning enterprise demands. Unfortunately, the questions raised by OECD remain largely unanswerable -- little or no study of how learning markets operate in the United States has been undertaken. This should be the top priority for the next major policy research effort to follow Workforce 2000.

A thorough assessment of how the learning market operates, in the United States and elsewhere, should address:

-- the needs for learning in terms of changing occupational (and other social and economic) requirements and opportunities;

-- the demands for learning by both individuals and employers;

-- the state of the art and projected developments in learning technology;

-- the market relationships among the suppliers of learning products and services, and between suppliers and their customers;

-- the means to finance the production and utilization of learning products and services; and

-- the impacts of both public and private policies on the operation of the market as a whole.

These topics do not only need to be studied invididually; they also need to be linked together in a comprehensive systems view of the learning enterprise. Moreover, this kind of research is needed not only in the United States and not only as a guide to domestic policy. Replicated in several or all other OECD member countries, such a study of learning markets would provide the basis for understanding the role of the learning enterprise as a factor of international comparative advantage, and perhaps also as an important sector for international trade and cooperation in its own right.

Policy

What the trends outlined in this report point to is an urgent need in the United States (and probably in other countries) for a national learning policy. Currently, the United States has a host of policies and programs addressing education, training, employment, welfare, commerce, science, technology, and so forth that affect the supply of or demand for learning in various forms. These diverse policies and programs are largely autonomous, often incoherent, and even contradictory. Cumulatively, they define, by default, a learning policy that lacks content, focus, or strategy. Yet this non-policy guides, however mysteriously, the second or first largest sector of the entire U.S. economy.

In the 1960s, growing awareness of human ecology led the U.S. government to consolidate and strengthen its policies for environmental protection. In the 1970s, a crisis in energy supply prompted the government similarly to integrate and coordinate its energy policies and programs. During the 1980s, the challenges of an unchecked cost spiral and new threats such as AIDS gave new focus and urgency to national health policies whose administration already was fairly centralized.

In the 1990s, an expanding workforce crisis will combine with these other crucial issues -- each of which has learning as a key component -- to make an innovative and coherent national learning policy an urgent requirement of public management.

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NOTES

1. Expressed in the Secretariat's note of December 15, 1988.

2. Kelly (1988).

3. See Blaschke and Abrams (no date), Blaschke and Watson (no date), Bracey (1987), Fletcher (1987), and Orlansky and String (1979).

4. Based on Ellson (1986), and the estimate that "teaching" represents 30-40 percent of total education costs. Also see Perelman (1987).

5. Steven Frankel (former director of assessment for Montgomery County, Md., Public Schools), "Finally, the Revolution in Teaching," *The Washington Post* (Nov. 23, 1986).

6. See Blaschke and Adams (no date) and Blaschke and Watson (no date).

7. David Birch in Subcommittee... (1983), *Hearings...*

8. AFL-CIO Committee... (1983).

9. David Birch in Subcommittee... (1983), *Hearings...*

10. AFL-CIO Committee... (1983).

11. July 3, 1989; p. 54.

12. Summarized by Berryman (1987).

13. "The Third Learning Revolution," *Electronic Learning* (Jan. 1988).

14. "For Americans Unable to Read Well, Life Is a Series of Small Crises," *The Wall Street Journal* (Jan. 17, 1984).

15. Personal communication.

16. Nancy J. Perry, "The Education Crisis: What Business Can Do," *FORTUNE* (July 4, 1988).

17. Definitions and estimates of what kinds of unemployment should be counted as "displaced" vary widely. An OTA report by Gorte (1986) noted that 5.1 million U.S. workers who lost their jobs between January 1979 and January 1984 were defined as displaced by the federal Bureau of Labor Statistics. The OTA report observed that this figure could be considered an underestimate, since it did not include unemployed workers who had been employed for less than three years, those whose employment was cut from full time to part time, displaced homemakers, and so forth. Most displaced workers eventually do become reemployed, though often after considerable personal hardship, and commonly in jobs with lower wages and benefits.

18. See Johnston and Packer (1987) for further details on trends cited in this section.

19. Council on Research and Technology (1988); also see American Association for the Advancement of Science (1989).

20. "As Pool of Skilled Help Tightens, Firms Move to Broaden Their Roles," *The Wall Street Journal* (May 8, 1989).

21. For example, in 1988, the Miami/Dade Public School System in Florida opened the first of a growing number of "satellite classrooms" located at the worksites of a major employers (in this case, a bank). Under this program, the employer provides the classroom--saving the district a quarter-million dollars in construction costs--and the distict provides the teaching staff and instructional materials. Employees have the advantage of commuting to and from work with their children, and having access to both children and teachers during the day. The employer gets reduced absenteeism and a low-cost benefit that is highly attractive to working parents.

22. See discussion of the federal JOBS program on page 33.

23. Barton (1982).

24. "Trends: Temping Today," *The Washington Post* (Jan. 31, 1987).

25. For instance, see AFL-CIO Committee... (1983).

26. See Gorte (1986) and Kelly (1988).

27. Census Bureau and Bureau of Labor Statistics data.

28. "Warnings of Lawyer Glut Are Sounded at ABA Convention," *The Washington Post* (July 31, 1983).

29. "For Doctors, Too, It's a Surplus," *US News & World Report* (Dec. 19, 1983).

30. "Computers Are Transforming Traditions of the Law Profession," *The Wall Street Journal* (Aug. 19, 1983).

31. This classification and much of the information presented here are adapted from a survey of government programs provided for the U.S. Labor Department's Commission on Workforce Quality and Labor Market Efficiency by Burt Yanow and Laudan Aron.

32. The vocational education program described above is not included again here. Some other activities mentioned under "education" may overlap with those noted under "training."

33. See Perelman (1988) for details. The study was performed by the author in 1987 and 1988 for the Western Governors' Association. Limitations of the study did not permit analysis of the substantial role of the nongovernmental sector in human capital investment in Colorado.

34. While the training provided by the state's National Guard units has an important impact on the state workforce (as does that given through other U.S. military organizations in the state), these were considered federal, rather than state government investments, and therefore were not included in this study.

35. This system is unique among the 50 states in combining authority for secondary and postsecondary vocational education.

36. Most of the state governments have similar programs, which aim mainly to encourage companies to locate new plants or facilities in the state.

37. Similar programs, established by the federal Smith-Lever Act of 1914, exist in other states.

38. Administration of this program was transferred to the state Education Department after this study. The Institutions Department also provides educational services to youth confined in correctional and mental health institutions.

39. The activities of this kind of agency are the sort that commonly are overlooked in national studies of "further" education and training. The Department's educational functions are not explicitly accounted for, but officials estimate that at least 25 percent of the budget goes to some kind of educational activity. Some are directed at health education of the general public, but most provide information and training to practitioners are a wide range of topics, from air pollution to disease control, family planning, drug abuse prevention and treatment, and consumer protection.

40. In practice, educational requirements for state jobs are minimal and flexible in Colorado. There also are only a few small programs for training of state personnel.

41. The latter occurred since the original WGA study. Up to that time, AFDC was not an "educational" program, and therefore had no presence in the investment budget described here.

42. Two boards--Nursing and Barber/Cosmetology--are unusual in that they also accredit schools in their fields.

43. This crude estimate is based on simple scaling of national data from Carnevale and Goldstein (1983) to the relative size of Colorado's population and economy.

44. Virtually all "private" elementary and secondary schools in the United States are not-for-profit, as are most degree-granting postsecondary institutions.

45. Data from *Statistical Abstract of the United States 1988*, Washington, DC: U.S. Bureau of the Census.

46. See Carnevale and Goldstein (1983) and Carnevale and Gainer (1989).

47. Above data on proprietary schools from Chance (1988).

48. "As Trade Schools Boom, Results Raise Concern," *The Washington Post* (July 10, 1989).

49. IBID.

50. Gallup Poll study commissioned by the New York Business Group on Health; see "Survey Finds 25% of Work Force Has Anxiety Disorder, Stress-Linked Illness," *The Wall Street Journal* (Oct. 20, 1989).

51. Jonathan Yardley, "Diapers and Soap Boxes," *The Washington Post* (Oct. 22, 1989).

52. Personal communication: Anne Wujcik, consultant, Talmis Inc.; also see Carroll and Mack (1984).

53. "Dai-Ichi Mostly Buying Expertise," *The New York Times* (Oct. 9, 1989).

54. "Japanese Chain Negotiating To Purchase Bloomingdale's," *The Washington Post* (Oct. 27, 1989).

55. Ithiel de Sola Pool, "Tracking the Flow of Information," *Science*, August 12, 1983.

56. U.S. Dept. of Education budget data.

57. Estimates from Kelly, 1988.

58. At the bottom of this group of 33 companies was a firm that invested only $790 per employee in R&D last year. The composite (a weighted average) R&D spending per worker of the surveyed companies in this business was $18,428.

59. The magazine surveyed companies reporting sales of at least $35 million and R&D expenses at least equal to $1 million or 1% of sales. So small firms or those making little investment in innovation are not included. But most academic enrollment is in school districts and public universities whose budgets would make them big businesses compared to companies on the magazine's list. And the point of this paper is that educational organizations should be among the leaders in innovation. So the "Scoreboard" is a relevant yardstick of education's R&D gap.

60. The OTA report (Roberts, 1988) estimated only one computer for every 30 students.

61. For instance, see McDermott (1987).

62. The program was terminated in the summer of 1989, after seven years of operation, by a new Superintendent.

63. Personal communication.

64. Stuart Krasny, president, SK&A Research (in Ross, 1988). Krasny also forecasts that interactive video systems, which now represent only 2 percent of training budgets will grow to 8 percent by 1992.

65. For example, see "Computers in School: A Loser? Or a Lost Opportunity?," *Business Week*, July 17, 1989; and "Computers Make Slow Progress in Class," *Science*, May 26, 1989.

66. Data from U.S. Small Business Administration.

67. "'Computer People': Yes, They Really Are Different," *Business Week* (Feb. 20, 1984).

68. Facts on surplus education derived from several sources, including: Thomas J. Moore, "Tinker, Tailor, Waitress, Clerk: Is It Worthwhile to Go to College?", *The Washington Post* (Oct. 23, 1983); "More U.S. Aid Sought to Stop Erosion of Grad-School Quality," *The Washington Post* (Dec. 13, 1983); Bob Kuttner, "The Declining Middle," *The Atlantic Monthly* (July 1983); and *Hearings on Technology and Employment*, Subcommittee on Science, Research and Technology of the Science and Technology Committee, and Task Force on Education and Employment of the Budget Committee, U.S. House of Representatives (June 7-23, 1983).

69. For instance, see Freeman (1971).

70. Until that time, the American Telegraph & Telephone Corp. operated the Bell system, a regulated public utility that had a virtual monopoly of telephone service in the United States. As a result of the settlement of an anti-trust suit against the company, AT&T turned over local telephone service to seven, new regional utility companies, while remaining in the long-distance service and equipment manufacturing businesses.

71. See "Easing Plant-Closing Pain: AT&T, Union Join to Aid the Displaced," *The Washington Post* (July 5, 1989). For further details on the "The Alliance," see Alexander (1989).

72. Carnevale and Goldstein (1983).

73. "Small business: the nation's training ground," *Business Week* (Sept. 5, 1983).

74. "Wharton Students Take a Long Trip on the Fast Road to Success." *The Washington Post* (March 26, 1984).

75. "When You Promise to Pay Training Costs," *The Washington Post* (Oct. 29, 1989).

76. V.W. Seidel and R. Seidel, eds, *Reforming Medicine: Lessons of the Last Quarter Century*, (New York: Pantheon, 1984); also, 1984 Senate testimony by Edward Martin, director of the U.S. Bureau of Health Care Delivery and Assistance.

77. Nancy J. Perry, "Saving the Schools: How Business Can Help," *FORTUNE* (Nov. 7, 1988).

78. "Lacking Good Results, Corporations Rethink Aid to Public Schools," *The Wall Street Journal* (June 27, 1989).

79. That is, they violate the *state* constitution, as opposed to the federal constitution. In the cases cited, as in several other states, the state constitution has explicit provisions mandating "an efficient system of public education." The U.S. constitution has no statement on education, and the federal Supreme Court so far has not found equal educational opportunity to be implied by the Bill of Rights.

80. Edward B. Fiske, "Colleges expected a backlash against soaring tuition, but not from the Justice Department." *The New York Times* (Oct. 25, 1989).

81. "Panel Recommends Changes In College Business Practices," *The Washington Post* (Sept. 13, 1989).

82. "Investigation Into Tuition Fixing Spreads; 55 Institutions Now Say They Are Targets," *The Chronicle of Higher Education* (Oct. 4, 1989).